

# **Ecological Baseline Study for the Zintel Canyon Wind Project**

Final Report  
April 2001 – June 2002

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## EXECUTIVE SUMMARY

Energy Northwest is proposing a second wind power development in Benton County, Washington. The first development, called Nine Canyon, is currently being constructed with full commercial operation expected late this summer. The Zintel Canyon Wind Project site is located west of the Nine Canyon Wind Project site. Energy Northwest contracted with Western Ecosystems Technology, Inc. (WEST) and Northwest Wildlife Consultants Inc. (NWC) to conduct a one-year baseline study and to assist with environmental permitting of the Zintel Canyon Project. WEST and NWC also conducted other ecological baseline studies, including the study at the adjacent Nine Canyon Project. They will be conducting the operational monitoring study for the Nine Canyon project and coordinating Technical Advisory Committee tasks during the operational phase.

This report summarizes the results of the ecological baseline studies conducted from April 2001 through early June 2002 and other relevant information for determining the impacts of the proposed project on wildlife, plants and habitat. Many of the baseline results reported for the Nine Canyon Project (Erickson *et al.* 2001a) are relevant to the Zintel Canyon Project because the two developments are adjacent to one another, consist of similar habitat types and topography, and are expected to be of similar size (e.g., similar electricity output). The ecological baseline study consists of 1) point count and in-transit surveys for wildlife species, 2) two aerial surveys within approximately five miles of the project boundary for visible raptor nests in 2001, 3) burrowing owl surveys within suitable habitat near proposed turbine strings and new roads, 4) vegetation mapping, and 5) rare plant surveys in native shrub-steppe habitat near the proposed gravel quarry site. In addition, relevant data such as the nocturnal migration study collected during the one-year baseline study at the adjacent Nine Canyon Project were reviewed and summarized. Information on sensitive plant and wildlife species within the vicinity of the project was requested from the U.S. Fish and Wildlife Service (USFWS), Washington Department of Fish and Wildlife (WDFW), and the Washington Natural Heritage Program (WNHP) and is reported in this document. The recent synthesis of baseline and operational monitoring studies at wind developments by Erickson *et al.* (2002) was also reviewed and utilized for understanding and predicting impacts from the Zintel Canyon Project.

The Zintel Canyon site is within the Columbia Basin Physiographic Province. The site is located approximately ten miles south of Kennewick, Washington and approximately seven miles west/southwest of the Columbia River. The Zintel Canyon Project site is considered an extension of the Nine Canyon Project site since it is located adjacent to the Nine Canyon site.

Energy Northwest is using Bonus 1.3 MW three-bladed horizontal axis turbines for the Nine Canyon Project. The turbines for the Zintel Canyon Wind Project will be similar to the Nine Canyon turbines, but the turbine vendor has not been selected at this time. The overall size of the Zintel Canyon Wind Project will likely be comparable to the Nine Canyon Project, which consists of 37 turbines generating a maximum of 48 megawatts (MW) of electricity.

The vegetation of the project site and surrounding area was originally the bluebunch wheatgrass-Idaho fescue zonal association, which was predominately grassland and shrub-steppe with deciduous riparian forests and scrub along the drainages (Franklin and Dyrness 1973). Agriculture and livestock grazing have converted the area to a mosaic of cultivated wheat fields, shrub-steppe, and Conservation Reserve Program (CRP) seeded grasslands.

Results of avian use surveys indicate predominantly low avian use and diversity in the Project area. A total of 57 species were identified during the surveys at Zintel Canyon and Nine Canyon. Eight species were observed during Nine Canyon avian surveys that were not observed during Zintel Canyon avian use surveys (American goldfinch, American pipit, Brewer's blackbird, double-crested cormorant, ferruginous hawk, golden eagle, varied thrush and Vaux's swift). Nine species were observed during Zintel Canyon avian surveys that were not observed during the Nine Canyon avian surveys (black-billed magpie, dark-eyed junco, gray-crowned rosy finch, mountain bluebird, rock wren, sharp-shinned hawk, tree swallow, violet-green swallow, and western kingbird). The mean number of species observed per survey (30-minute point count) for Zintel Canyon was 2.44, which is very similar to estimates obtained for Nine Canyon (2.36/survey). We estimated an average of 19.80 bird observations per survey. Highest overall avian use occurred in the winter (39.66/survey), followed by fall (12.68), spring (9.20), and summer (6.75). The higher use in winter was primarily due to observations of relatively large flocks of birds (i.e., 1100 Canada geese, 105 horned larks). Estimates of use are similar at Zintel Canyon compared to Nine Canyon in the spring (10.81), summer (5.82) and fall (10.20) and higher at Zintel Canyon in the winter. Higher winter use is again due to the few large flocks of Canada geese that were typically observed flying well above turbine heights.

A large majority of bird observations were horned larks and western meadowlarks. The most common raptors observed were northern harrier, red-tailed hawk, Swainson's hawk, American kestrel, and rough-legged hawks. Most of the rough-legged hawks were observed in winter. Canada geese use was observed, mostly during the winter, and common ravens were observed throughout the study period.

Passerines were the most abundant avian group observed in the spring, summer and fall; waterfowl (i.e., Canada geese) were the most abundant group in winter. The next most abundant avian group observed varied with season, with waterbirds in the fall and spring and raptors in the summer.

Compared to the results of studies at other wind developments including Buffalo Ridge (MN), Foote Creek Rim (WY), Klondike (OR), Nine Canyon (WA), Stateline (OR/WA), and Vansycle (OR), the Zintel Canyon Project site had raptor use estimates near the average in the summer and winter, near the low end in the spring, and near the high end in the fall. The higher use in the fall appears to be due to an increase in American kestrel use during this

season. Raptor mortality has been very low at all new wind projects. Only one raptor fatality was recorded during a four-year study at the Buffalo Ridge Wind Plant (~450 turbines). At the Foote Creek Rim Phase I wind plant (69 turbines), where there is much higher average raptor use than at the other sites (especially golden eagles), including Zintel Canyon, five raptor fatalities were recorded over a two-year study (Johnson *et al.* 2001). No raptor fatalities have been observed at Klondike based on five months of surveys, and Vansycle based on 12 months of surveys (Erickson *et al.* 2000). Two raptor fatalities (both red-tailed hawks) have been observed at Stateline between July 2001 and May 2002, based on over 1000 turbine searches.

Flight height characteristics were estimated for avian species and groups. Percentages of observations below, within and above the rotor swept area (RSA) of the Bonus 1.3 MW turbine (RSA height 29 – 91 m above ground level) were reported. Sharp-shinned hawk, great blue heron and unidentified sparrow and eagle had 100% observed within the RSA based on less than 3 flocks for each group. Of the more common species observed, rough-legged hawk (46.0%), Swainson's hawk (45.5%), red-tailed hawk (43.5%), prairie falcon (40.0%) and common raven (37.5%) were most often observed flying within the RSA. Smaller passerines, including horned lark (6.4%) and western meadowlark (0.0%), were not often observed within the RSA.

Relative exposure indices (avian use multiplied by proportion of observations species flew within the rotor swept area) were calculated by species. This index is only based on flight height observations and relative abundance and does not account for other possible collision risk factors such as foraging behavior. The only small bird species with a significant turbine exposure index is horned lark. Larger bird species with the highest exposure index were Canada goose, common raven and rough-legged hawk. Mortality studies at other wind plants have indicated that although ravens are often observed at wind plants within the zone of risk, they appear to be less susceptible to collision with wind turbines than other similar size birds (e.g., raptors, waterfowl).

Aerial raptor nest surveys within approximately 5 miles of the proposed Zintel Canyon turbine strings were completed on April 28 and June 5, 2001. Raptor nesting activity was in general low in both years, especially within 2 miles of the proposed project facilities. Only one active raptor nest (Swainson's hawk) was documented within 2 miles of the project area. In the 2001 survey, a total of 18 active nests were documented within the survey area (~400 sq. km), representing 4 species (6 Swainson's hawk nests, 6 common raven, 3 red-tailed hawk, 1 American crow, 1 ferruginous hawk). There were three active raptor nests (2 Swainson's hawks, 1 red-tailed hawk) that were located within three miles of the proposed project facilities.

A breeding bird survey was conducted along Owens Road beginning to the north at the intersection with Bateman Road and to the south at the intersection of Beck Road. The primary purpose of this survey was to document avian use of this canyon by breeding

passerines, especially sensitive species such as sage thrashers, sage sparrows, and loggerhead shrikes. The species are not typically observed at the fixed point survey stations that are located on the ridges where turbines will be built. Twenty point count stations were established along this route each approximately 0.3 miles apart. Two full surveys and one partial survey were conducted. Surveys were conducted between 0600 and 1000. Observations were separated between observations  $\leq 50$  m and  $>50$  m of the observer.

A total of 479 observations representing 23 species and one unidentified grouping (unidentified raptor) were observed during the three surveys. Horned larks (32% of observations) and western meadowlarks (26%) made up over half of the observations. There were several species that were documented during these surveys that had not been documented during the fixed point surveys including Brewer's sparrow, cliff swallow, grasshopper sparrow, great horned owl and sage thrasher.

A nocturnal study was conducted at the Nine Canyon site by ABR Inc. in the fall 2000 and spring 2001 bird migration periods (Erickson *et al.* 2001a). Because of the proximity and similarity of habitat and elevations, these observations are judged applicable to the Zintel Canyon site. The sampled area using the long-range setting includes the locations of nearly all the proposed Zintel Canyon turbines. Results indicate that low to moderate numbers of bird targets flew within the vicinity of the Nine Canyon and the proposed Zintel Canyon Project areas based on 10 nights of sampling in fall 2000 and 9 nights of sampling in spring 2001. Furthermore, approximately 86% of those birds flew at altitudes above the proposed turbine height. Because of the high daily variation in mean migration rates (due to limited sample size and variable migration patterns), actual migration rates could be higher or lower at the Nine Canyon/Zintel Canyon Wind Project site than at the nearby Stateline wind plant. Daily mean flight altitudes were similar to those recorded at the nearby Stateline and Vansycle wind-energy facilities. Relatively low bird mortality (including nocturnal migrants) has been recorded at the Vansycle and Stateline and other new generation wind plants, especially when compared to the nocturnal bird passage rates recorded at those sites.

There are no structures near the proposed project facilities that would appear to support bats, and given the lack of open water (used for drinking and foraging), bat use in the project area is suspected to be low. Monitoring studies conducted at the Vansycle wind project in Oregon (Erickson *et al.* 2000), and the Stateline wind project in Oregon and Washington (Erickson *et al.* 2002) within similar habitat and topography suggests that migrating bats are likely to fly through the area.

Twelve species that are either state or federal listed species or were identified as species of local concern were documented in the project area or within a 3-mile radius. These species include burrowing owl, ferruginous hawk, golden eagle, loggerhead shrike, merlin, prairie falcon, sandhill crane, short-eared owl, snowy owl, Swainson's hawk, Townsend's ground squirrel and Vaux's swift. Seven of the twelve species were observed during the 2001-2002

avian use surveys - loggerhead shrike, merlin, prairie falcon, sandhill crane, short-eared owl, Swainson's hawk, Townsend's ground squirrel. The Townsend's ground squirrel is listed only because it is a prey item for ferruginous hawks and other raptors. No ferruginous hawks were observed during the avian use surveys at the Zintel Canyon Project site, but one active ferruginous hawk nest was located approximately 3.5 miles from the project site. Vaux's swift and golden eagle were observed during the one-year baseline study at the Nine Canyon Project site. The other species (snowy owl and burrowing owl) were observed by others (e.g., landowners) prior to the studies. Although all are considered protected wildlife, only three of the seven species documented during Zintel Canyon surveys, loggerhead shrike, merlin, and sandhill crane, are classified as Species of Concern (State Candidate, State Candidate and State Endangered, respectively) by the Washington Dept. of Fish and Wildlife (WAC-232-12-297).

In general, project impacts to vegetation include trampling, uprooting, or collecting, as well as loss of habitat or changes in hydrology. Potential impacts to mammals and birds include injury or mortality, loss or destruction of habitat, or avoidance of an area. Impacts may occur during project construction and/or operation. Impacts to special status plant species are expected to be very low. All turbine strings are currently proposed to be located in cultivated agricultural lands. Some native shrub-steppe habitat will be temporarily impacted by the proposed gravel quarry operations.

The most probable impact to birds resulting from the project is direct mortality or injury due to collisions with the turbines or guy wires of temporary or permanent meteorological towers. Fatality projections based on the results of studies conducted at the modern 38-turbine Vansycle wind plant in Umatilla County, Oregon (Erickson *et al.* 2000), and the modern over 400-turbine Buffalo Ridge Wind Plant in southwestern Minnesota (Johnson *et al.* 2000a), indicate 0.6 – 2.8 bird fatalities per turbine per year. Most of these fatalities will likely be common passerines such as horned larks. The actual mortality could vary significantly from these projections and would depend on the many factors including the actual number of turbines developed and other unmeasured factors. Overall raptor mortality for this project is expected to be low, considering the low to moderate raptor use and low raptor nesting in the area, the small size of the project, the low mortality of raptors observed at other newer generation wind projects outside California, and the type and configuration of turbines. Based on the relatively low to moderate raptor use and low nesting density in the project area and the relatively small size of the project, we would expect no raptor mortality in most years of operation, with a potential for an occasional raptor fatality over the life of the project.

Bat mortality has been reported from other wind development sites, primarily during fall migration/dispersal periods; however, bat mortality at the Vansycle Wind Project did not include any listed species (Erickson *et al.* 2000). The best estimate for bat mortality at the Zintel Project would be 0.74 bats/turbine per year based on the Vansycle estimate. The actual bat mortality could vary significantly from this number, depending on bat use of the

area and size of the project. Any bat mortality at the project site is likely to involve non-listed species, particularly since the Yuma myotis and Townsend's big-eared bat are not known to occur in the area. However, depending on actual use of the area and migratory patterns, any bat collisions with turbines would not likely affect populations.

The Nine Canyon Technical Advisory Committee (TAC) is composed of representatives from Energy Northwest, the Lower Columbia Basin Audubon Society, Washington Department of Fish and Wildlife, U. S. Fish and Wildlife Service, Benton County representatives, the landowners, and consultants conducting the monitoring studies. The TAC will evaluate the operational monitoring data collected for the adjacent Nine Canyon Project as well as other relevant projects such as Stateline and Klondike, to determine the monitoring requirements for the Zintel Canyon Project.

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## **INTRODUCTION AND BACKGROUND**

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## **STUDY/PROJECT AREA**

The Zintel Canyon site is within the Columbia Basin Physiographic Province. The site is located approximately ten miles south of Kennewick, Washington and approximately seven miles west/southwest of the Columbia River (Figure 1). The Zintel Canyon Project site is considered an extension of the Nine Canyon Project site since it is located adjacent to the Nine Canyon site.

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The vegetation of the project site and surrounding area was originally the bluebunch wheatgrass-Idaho fescue zonal association, which was predominately grassland and shrub-steppe with deciduous riparian forests and scrub along the drainages (Franklin and Dyrness 1973). Agriculture and livestock grazing have converted the area to a mosaic of cultivated wheat fields, shrub-steppe, and Conservation Reserve Program (CRP) seeded grasslands. At this time, all turbines and new roads are proposed to be located within wheat fields.

## **AGENCY/LOCAL AUDUBON CONSULTATION**

Consultation with local, regional, and central office personnel of WDFW and the USFWS was initiated during spring 2000 for the Nine Canyon Project. The general study plan implemented for Nine Canyon and followed for Zintel Canyon was provided to Michelle Eames of the USFWS and Mark Teske and Lee Stream of WDFW in May 2000 for review. This protocol was later provided to local WDFW personnel (Don Larsen and Paul LaRiviere) and to board members of the Lower Columbia Basin Audubon Society (LCBAS) in the Tri-Cities. The Nine Canyon Technical Advisory Committee (TAC) is composed of representatives from Energy Northwest, the Lower Columbia Basin Audubon Society, Washington Department of Fish and Wildlife, U. S. Fish and Wildlife Service, Benton County representatives, the landowners, and consultants conducting the monitoring studies. The TAC was formed to oversee and evaluate monitoring activities for the Nine Canyon Project. Energy Northwest and WEST made a presentation of the Zintel Canyon Wind Project to the committee on February 26, 2002. In addition, Energy Northwest and WEST provided a presentation of the Zintel Canyon Wind Project to the LCBAS board members on May 21, 2002.

## **METHODS**

### **Vegetation Mapping**

The vegetation of the project site and surrounding area (approximate 2 mile buffer of proposed turbine strings) was mapped based on ground observations and black and white aerial photographs obtained from the USGS. The following generally describes the mapping process and a description of each vegetation type located during the assessment.

The project's field biologist visually assessed the project area from access roads, and delineating vegetation types based on the dominant cover type. Sites not visible from roads were mapped by interpreting the aerial photos by comparison of known sites to unknown sites. Plant species were identified during walking transects conducted through representative vegetation types. The principal vegetation types identified in the project area are:

AD – agricultural lands, primarily dryland wheat. Throughout the study period, fields varied from being plowed, to having wheat crop or stubble present.

TR – planted groves or individual trees. The trees noted were primarily black locust (*Robinia pseudoacacia*). Live trees and snags located at old homesteads and existing farmsteads. These trees may provide nesting or roosting structure for raptors and smaller birds, and if loose bark or hollow snags are present, roosting structure for bats.

SS – shrub-steppe. Areas classified as shrub-steppe are similar to those described below for grassland with the addition of an obvious shrub component (>50%) consisting of gray rabbitbrush (*Chrysothamnus nauseosus*), big sagebrush (*Artemisia tridentata*), and three-tip sage (*Artemisia tripartita*). Big sagebrush is more common at lower elevations and three-tip sage is more common at higher elevations. Buckwheat (*Eriogonum spp.*) and balsamorhiza (*Balsamorhiza spp.*) are occasionally found on thin-soiled dry slopes.

CRP – Conservation Reserve Program seeded grasslands. Areas defined as CRP are dominated by bunchgrass that has been planted on previously farmed ground. The dominant grass in older established fields is crested wheatgrass (*Agropyron cristatum*) and in younger fields, various seed mixtures were used, resulting in fields dominated by Sherman's big bluegrass (*Poa ampla*).

GR – grassland. Areas defined as grassland are dominated by native grass or invasive alien grass species. The dominant grasses in undisturbed areas are Sandberg's bluegrass (*Poa secunda*) and bluebunch wheatgrass (*Pseudoroegneria spicata*). Cusick's bluegrass (*Poa cusickii*) is present on some sites. Sandberg's bluegrass is the dominant native species. Many areas dominated by native bunchgrasses have inclusions of invasive alien grass species such as cheatgrass (*Bromus tectorum*) and cereal rye (*Secale cereale*). Areas that have a history of disturbance are predominantly cheatgrass and invasive forbs such as tumbled mustard (*Sisymbrium altissimum*), Russian thistle (*Salsola kali*), and horseweed (*Conyza canadensis*). Scattered shrubs, such as gray rabbitbrush and big sagebrush, are occasionally found at some grassland sites. For mapping purposes, the CRP and GR classes were combined because of the difficulty in determining which parcels were currently enrolled in the CRP program.

DE – homesites or storage buildings associated with farming activities. Abandoned buildings or infrequently used structures may provide roosting and nesting structure/habitat for some birds (swallows, Say's phoebe) and roosting structure for bats.

### **Rare Plant Surveys at the Proposed Gravel Quarry Site**

At this time, no native or CRP habitat is expected to be impacted by construction of turbines and new roads. A rare plant survey was conducted in suitable habitat at the proposed Zintel Canyon. The quarry site is located in T7N R29E Section 11, and is expected to be approximately five to nine acres in size. Part of the quarry site is located in native shrub-steppe habitat. Agriculture fields are located to the north and east of the site. The site, which is privately owned, is located on a hillslope at approximately 1,600 feet elevation. A list of special status plants with the

potential to occur in the project area was developed by reviewing federal and state lists of special status plant species known to occur or potentially occurring in Benton County and in the habitat found at the site. The technical report from another recent energy project in the county was also consulted (Eagle Cap Consulting 2001). In order to become familiar with the special status plants potentially occurring at the site, information was gathered from available literature sources and from a visit to the Washington State University herbarium in Pullman to observe specimens (WNHP website, Hitchcock and Cronquist 1973). Information gathered included habitat preferences, morphological characteristics, phenological development time-lines, and species ranges. *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973) was used as the authority for plant identification and scientific names.

The survey was conducted on June 5, 2002. The survey was conducted by walking the site and recording all plant species observed. Particular attention was paid to search for species on the list of special status plant species developed during the pre-field review. The survey was timed so that most species on the special status plant species list would be identifiable. Photographs of the site were also taken.

### **Diurnal Fixed Point and In-Transit Avian Use Surveys**

The goal of the avian use surveys was to estimate the temporal and spatial use of the study area by birds. The avian use surveys combined observations collected at six fixed-point circular plots in the study area with in-transit observations of birds made while driving to and from the study area. All wildlife species of concern and unusual species observed were recorded while the observers were in the study area traveling between observation points and while conducting of field activities.

#### Fixed-point Surveys

Each plot is an approximate 800 m radius circle centered on an observation point location (Figure 2). Landmarks were located to identify the 800 m boundary of each observation point. Observations of birds beyond the 800 m radius were recorded, but analyzed separately from observations made within the plot.

All sightings of birds, mammals, reptiles, and amphibians in and near plots during the 30-minute plot surveys were recorded. A unique observation number was assigned to each sighting. Weather information such as temperature, wind speed, wind direction and cloud cover was recorded for each survey point. The following data were recorded: date, start and end time of observation period, plot number, species or best possible identification, number of individuals, sex and age class when known, distance from plot center when first observed, closest distance, altitude above ground, behavior, habitat(s), and whether observed during one or more of the four instantaneous counts. Flight paths were mapped for raptors and species of concern and given corresponding observation numbers. The map indicates whether the bird was within or outside the survey radius based on reference points at known distances from the plot center. Visual and binocular scanning of the entire plot area and beyond were continuously performed.

A field data sheet for the plot surveys is found in the monitoring protocol (WEST 2000). Behavior categories recognized included perched (PE), soaring (SO), flapping (FL), flushed (FH), circle soaring (CS), hunting (HU), gliding (GL), and other (OT). Initial flight patterns and habitats were identified with "1" in the data sheet and subsequent patterns, and habitats (if any) recorded as an "x" or check mark. For example, if a raptor was first sighted perched, and then left its perch and flew out of the study area, then a 1 was written in the box next to perching, and an "x" or check mark was written in the box for flapping. The flight direction of the bird was recorded. Flight altitude at first observation was recorded to the nearest meter and any other altitude categories traversed by the bird were check-marked. Observations above 15 m were generally recorded in 5 m intervals. Altitude categories correspond to the approximate heights below, within, and above the space generally occupied by standard turbine blades. Habitats were recorded as fallow (FA), stubble (ST), wheat (WW), plowed (PL), grassland (GR), shrub-steppe (SS), trees (TR), developed (DE) and other (OT). Any comments or unusual observations were recorded in the comment section of the data form. Locations of raptors, other large birds, and any species of concern seen during each instantaneous count were recorded on the field maps by observation number. Locations of raptors, other large birds (excluding ravens) and any species of concern were recorded on field maps and assigned unique observation numbers. Flight paths were digitized using ARCVIEW 3.2.

#### Incidental/In-transit Observations

All wildlife species of concern and uncommon species observed while field observers were traveling between plots were recorded on incidental/in-transit data sheets. Other incidental observations made during other surveys or visits to the sites were also recorded. These observations were recorded in a similar fashion to those recorded during the plot studies. The observation number, date, time, species, number, sex/age class, height above ground, and habitat were recorded. Observations of species of concern and uncommon species were recorded in additional detail, mapped on a USGS quadrangle map by observation number, and digitized using ARCVIEW 3.2.

#### Observation Schedule

Visual observations were conducted at intervals designed to include approximately all daylight hours. During a set of surveys, each selected plot was visited once. Weekly surveys took place during daylight hours. Observation days were divided into two periods, morning and afternoon, with each station being surveyed for 30 minutes. A pre-established schedule was developed prior to field work to ensure that each station was surveyed about the same number of times each period of the day, during each season, and to most efficiently utilize personnel time. The schedule was altered in response to adverse weather conditions or farming operations, which required delays and/or rescheduling of observations. Fog was a common adverse weather problem during the fall and winter that caused some delays and re-scheduling.

## Statistical Analysis

### *Avian Use*

Species lists were generated by season including all observations of birds detected regardless of their distance from the observer. The number of birds seen during each point count survey was standardized to a unit area and unit time surveyed. The standardized unit time was 30 minutes and the standardized unit area was 2.01 km<sup>2</sup> (800 m radius view shed for each station). For example, if four raptors were seen during the 30 minutes at a point with a viewing area of 2.01 km<sup>2</sup>, these data may be standardized to  $4/2.01 = 1.98$  raptors/km<sup>2</sup> in a 30-minute survey. For the standardized avian use estimates, only observations of birds detected within 800 m of the observer were used. Estimates of avian use (expressed in terms of number of birds/plot/30-minute survey) and associated 90 percent confidence intervals were tabulated and plotted to compare differences in avian use between 1) avian groups 2) project sites (Nine Canyon versus Zintel Canyon) and 3) seasons.

### *Avian Diversity and Richness*

The total number of unique species was calculated by season. The mean number of species observed per survey (i.e., per station per 30-minute survey) was tabulated to illustrate and compare differences in mean number of species per survey between seasons.

### *Avian Flight Height/Behavior*

The first flight height recorded was used to estimate percentages of birds flying below, within and above the rotor swept area (RSA). The zone of collision risk for the Bonus 1.3 MW turbines is 29-91 m above ground level (AGL). We used this range, although there is a possibility the turbine selected for Zintel Canyon may be different.

### *Avian Exposure Index*

A relative index to collision exposure ( $R$ ) was calculated for bird species observed during the fixed-point surveys using the following formula:

$$R = A * P_f * P_t$$

Where  $A$  = mean relative use for species  $i$  (observations within 800 m of observer) averaged across all surveys,  $P_f$  = proportion of all observations of species  $i$  where activity was recorded as flying (an index to the approximate percentage of time species  $i$  spends flying during the daylight period), and  $P_t$  = proportion of all flight height observations of species  $i$  within the rotor-swept area (RSA). This index does not account for differences in behavior other than flight characteristics (i.e., flight heights and percent of birds observed flying).

### *Avian Flight Patterns and Behavior*

Maps of flight paths of raptors and other species of concern were generated and reported to illustrate patterns in flight paths and behaviors.

### *Data Compilation and Storage*

A Microsoft® ACCESS database was developed to store, organize and retrieve field observation data. Data from field forms were keyed into electronic data files using a pre-defined format to facilitate subsequent QA/QC and data analysis. All field data forms, field notebooks, and electronic data files were retained for reference.

### *Quality Assurance/Quality Control (QA/QC)*

QA/QC measures were implemented at all stages of the study, field surveys, data entry, and during data analysis and report writing. At the end of each survey day, each observer was responsible for inspecting his or her data forms for completeness, accuracy, and legibility. Weekly, and possibly daily, data forms were reviewed to insure completeness and legibility; any problems detected were corrected. Any changes made to the data forms were initialed and dated by the individual making the change.

Data was entered into electronic database files, queried and reviewed for inconsistencies. Any irregular codes detected, or any data suspected as questionable were discussed with the observer and study team leader. All changes made to the raw data were documented for future reference.

### **Breeding Bird Surveys**

A breeding bird survey was conducted along Owens Road beginning to the north at the intersection with Bateman Road and to the south at the intersection of Beck Road (Figure 3) in May and June of 2001. The primary purpose of this survey was to document avian use of this canyon by breeding passerines, especially sensitive species such as sage thrashers, sage sparrows, and loggerhead shrikes, in the vicinity of the project. These species were typically not observed at the fixed point survey stations, which are located primarily in wheat fields where the turbines will be built. Twenty point count stations were established along this route, each approximately 0.3 miles apart. Each station was surveyed for 10 minutes. Two full surveys and one partial survey were conducted in May and June. Surveys were conducted between 0600 and 1000. Detections made within 50 m of the observer were separated from those made outside 50 m.

### **Raptor Nest Surveys**

The goal of the raptor nest surveys was to gather information on nesting species visible from the air, including nest locations, timing, and reproductive success in the study area. Two aerial surveys were conducted in 2001 within approximately 5 miles of the Project site (Figure 4). The focal species for the nesting surveys were ferruginous hawks, prairie falcons, and Swainson's hawks. Given the paucity of available nest trees and habitat, a nearly total count of nesting

buteos in the survey area was possible. Orchards and similar habitats north of the project site were excluded from the helicopter survey.

Project site locations, the associated 5-mile buffer boundary lines, and all historic raptor nests were marked on USGS 7.5-minute quadrangle maps prior to conducting the helicopter surveys. WDFW maps of historical raptor territories and nests were reviewed prior to the surveys and used as supplemental information. The survey area (site plus buffer) was systematically surveyed by helicopter. All suitable nesting areas, such as rimrock or trees, were searched for raptor activity and nests.

Surveys were conducted on April 28 and June 5, 2001 to cover the nesting period for the species of concern. All nests, whether active or inactive, were assigned an identification number. The Nine Canyon operational monitoring plan (Energy Northwest *et al.* 2001) included ground visits when possible to previously active (active in 2001) raptor nests that are located within approximately 3 miles of the Nine Canyon turbines. These surveys were conducted during the 2002 breeding seasons and are summarized in this report.

### **Burrowing Owl and Ground Squirrel Surveys**

In May 2002, walking surveys were conducted within 500 feet of the proposed turbine locations and proposed gravel quarry site in suitable habitat in an attempt to locate evidence of nesting burrowing owls and Townsend's ground squirrels. In addition the likely access road from Owens Road to the turbine strings was also surveyed.

### **Nocturnal Migration Study**

A nocturnal migration study was conducted by ABR Inc. at the adjacent Nine Canyon site during fall migration 2000 and spring migration 2001 using radar and visual observations (Mabee and Cooper 2000a, Mabee and Cooper 2001, Erickson *et al.* 2001a). Because of the proximity and similarity of habitat and elevations, these observations are judged applicable to the Zintel Canyon site. The sampled area using the long-range setting includes the locations of nearly all the proposed Zintel Canyon turbines.

Sampling was timed to coincide with late shorebird migration (Denny 2000), peak passerine migration (Hudson 2000, LaFramboise and LaFramboise 1999), the migratory period for bats (Fitzgerald *et al.* 1994), and early waterfowl migration. Ten nights were sampled between September 4 and October 9, 2000 and 10 nights were sampled between March 31 and May 16, 2001. One of the sampling nights in 2001 was dropped due to weather problems; therefore, nine sampling nights were used for analysis. Each night, a mobile radar lab was used to sample for 5.5 - 6.5 hours during crepuscular and nocturnal conditions (i.e., between 18:30 and 03:00). Visual observations were also conducted with a night-vision scope each night (~1 hour/night) to identify low-flying birds and bats. Detailed methods used during the 2000 and 2001 surveys are provided in Mabee and Cooper (2000) and Mabee and Cooper (2001).

The mobile radar laboratory consisted of two marine radars mounted on a pickup-truck camper. The surveillance radar (Furuno Model FCR-1411) scanned the surrounding area and obtained information on flight direction, movement rates, and ground speed of targets. The surveillance radar was used at two settings, the 1.4 km and 5.6 km range. At the 1.4 km-range setting, individual small-bodied passerines as well as larger birds and flocked birds can be detected. Some targets could be two or more birds flying so close together that the radar displays them as one object. It is usually not possible to separate a unidirectional bat target from a bird target with the equipment. At the 5.6 km range setting, we collected data on numbers, flight behaviors and flight directions of targets, and had optimal performance for detecting medium and large-sized birds (e.g., waterfowl) and small-bodied birds in flocks (e.g., passerines). The vertical radar system measured flight altitudes of birds (Cooper *et al.* 1991). In 2000, a FCR-1411 radar was used (Mabee and Cooper 2000). In 2001, a FCR-1510 model was mounted in a vertical position to collect flight altitude data following Harmata *et al.* (1999). In this position, the vertical radar sampled an arc of airspace radiating from the lab in an east-west orientation down to ground level.

### **Reviews for Sensitive, Threatened, and Endangered Species**

Current listings of federal and state endangered, threatened, and special status species were obtained through relevant government agencies. Information regarding habitat requirements and documented or suspected occurrence of listed species in the project vicinity was obtained from government agencies, non-governmental organizations, local consultants familiar with the project area, species specialists, and from on-site field surveys. A review of published literature on endangered, threatened, and special status species in the project area was also conducted to determine habitat requirements and potential for occurrence in the project area. Contacts were made with the following agencies and organizations:

- U.S. Fish and Wildlife Service (USFWS)
- Washington Natural Heritage Program (WNHP)
- Washington Department of Fish and Wildlife (WDFW)
- Lower Columbia Basin Audubon Society (LCBAS)

The USFWS provided a list of federal endangered, threatened, proposed and candidate species, and designated critical habitat potentially occurring in the project vicinity. The WNHP maintains a database on rare plants, high quality wetland ecosystems, and high quality terrestrial ecosystems in the state of Washington. The WNHP conducted a search of their database for records of occurrence in the vicinity of the project area and provided a list of species and habitats with accompanying species information.

The WDFW Species of Concern list was reviewed, and any species potentially occurring in the project area was included in the analysis for possible impacts from the project. Furthermore, a request was made to WDFW for a database search for known priority habitats and species

occurring within the project area and within a 3-mile radius of the project. The WDFW provided 1:24,000 scale maps and descriptions of the requested area. WDFW personnel also noted species of concern that could occur in the project area, but are not formally listed.

Field surveys in the project vicinity for sensitive species included nest surveys, in-transit surveys for raptor species and other species of concern, point count surveys for all wildlife and grassland walking surveys near proposed project facilities, and rare plant surveys near the proposed gravel quarry site. The raptor nest surveys were conducted in the spring/early summer of 2001, and the search area included an approximate 5-mile buffer of the project site in 2001. Nesting habitat, including known historic nest sites, was searched by helicopter. Point count and in-transit surveys were initiated in April 2001 and were conducted on a weekly basis (except for a few missed surveys due to weather). In addition, we reference information regarding sensitive species observed during the Nine Canyon Project baseline study (Erickson *et al.* 2001a).

## **RESULTS**

### **Vegetation Mapping**

The vegetation map for the Zintel Canyon Wind Project Site and adjacent areas is found in Figure 5. Table 1 summarizes the vegetation of this 6719 hectare area. Because of the difficulty in determining whether a grassland is formally enrolled in CRP, we labeled all grasslands (including CRP) as GR. The predominant vegetation types are dryland agriculture (68.9% wheat fields in their various stages) and CRP and other grasslands (24.1%), and some shrub-steppe habitat (6.8%). The composition is similar to Nine Canyon in general, with slightly less grassland and more shrub-steppe habitat in the general vicinity of the Zintel Canyon Project.

### **Rare Plant Surveys at the Proposed Quarry Site**

The list of special status plant species with potential for occurrence at the proposed Zintel Canyon quarry site is presented in Table 2. No federally-listed species were included on the list; however one State Threatened species, ten State Sensitive species, and seven State Review species could potentially occur. State listed species are tracked by the Washington Natural Heritage Program and the Washington Department of Fish and Wildlife.

No special status plant species were found at the site during the survey. The habitat was somewhat degraded due to scattered debris/garbage piles throughout the site; surrounding land uses, which include cropland, dirt roads, a transmission line, may also influence the site conditions. A list of species that were observed at the site is shown in Table 3.

**Table 1. Composition of habitats within the Zintel Canyon study area.**

Habitat Class	Hectares	%Composition
Dryland Agriculture (AD)	4630.9	68.9
Developed (primarily residential) (DE)	12.8	0.2
Grassland/Conservation Reserve Program (GR/CRP)	1619.9	24.1
Shrub-steppe (SS)	455	6.8
Trees (TR)	0.1	<0.01
Grand Total	6718.7	100.0

**Table 2. Special-status plant species with potential for occurrence at the Zintel Canyon quarry site.**

Common Name/Scientific Name	Typical Habitat	Status*	ID Period
constricted douglas' onion <i>Allium constrictum</i>	shrub-steppe	S	May - July
Palouse milkvetch <i>Astragalus arrectus</i>	shrub-steppe, grassy hillsides	S	May - June
Columbia milkvetch <i>Astragalus columbianus</i>	sandy loam, gravelly soil, shrub-steppe	T	March - May
Idaho milkvetch <i>Astragalus conjunctus</i> var. <i>rickardii</i>	shrub-steppe	R1	May - June
pauper milkvetch <i>Astragalus misellus</i> var. <i>pauper</i>	shrub-steppe	S	May - June
rosy pussypaws <i>Calyptidium roseum</i>	shrub-steppe, swales	S	May - June
bristle-flowered collomia <i>Collomia macrocalyx</i>	shrub-steppe	S	May - June
miner's candle <i>Cryptantha scoparia</i>	shrub-steppe	R1	May - June
Snake River cryptantha <i>Cryptantha spiculifera</i>	shrub-steppe, open slopes and flats	S	May - July
desert dodder <i>Cuscuta denticulata</i>	shrub-steppe	S	May - August
Piper's daisy <i>Erigeron piperianus</i>	sage steppe, dry open areas	S	May - June
Great Basin gilia <i>Gilia leptomeria</i>	shrub-steppe	R1	May - June
small-flowered nama <i>Nama densum</i> var. <i>parviflorum</i>	sandy areas, shrub-steppe	R1	April - June
coyote tobacco <i>Nicotiana attenuata</i>	dry open places	S	June - September
caespitose evening-primrose <i>Oenothera caespitosa</i> ssp. <i>caespitosa</i>	road cuts, dry hills and talus slopes	S	May - July
brittle prickly-pear <i>Opuntia fragilis</i>	dry hillsides, open ground	R1	May - June
winged combseed <i>Pedtocarya linearis</i>	open dry places	R1	April - May
fuzzytongue penstemon <i>Penstemon eriantherus</i> var. <i>whitedii</i>	foothills, sage-steppe	R1	May - July

\*Washington State Status

**T: State Threatened** - Taxa that are likely to become Endangered in Washington within the near future if factors contributing to their decline continue.

**S: State Sensitive** - Taxa that are vulnerable or declining, and could become Endangered or Threatened in Washington without active management or removal of threats.

**R1: State Review Group 1** - Taxa for which there is insufficient data to support listing in Washington as Endangered, Threatened, or Sensitive.

**Table 3. Species observed at the Zintel Canyon quarry site.**

Family	Scientific Name	Common Name
Asteraceae	<i>Achillea millefolium</i>	yarrow
	<i>Artemisia tridentata</i>	big sagebrush
	<i>Balsamorhiza sagittata</i>	arrowleaf balsamroot
	<i>Chaenactis douglasii</i>	false yarrow
	<i>Chrysothamnus nauseosus</i>	common rabbitbrush
	<i>Crepis setosa</i>	hawksbeard
	<i>Erigeron pumilis</i>	shaggy fleabane
	<i>Lygodesmia juncea</i>	skeletonweed
	<i>Senecio</i> sp.	groundsel
	<i>Tragopogon dubius</i>	salsify
Brassicaceae	<i>Sisymbrium altissimum</i>	tumblemustard
Fabaceae	<i>Lupinus sericeus</i>	silky lupine
	<i>Vicia villosa</i>	wooly vetch
Poaceae	<i>Agropyron spicatum</i>	bluebunch wheatgrass
	<i>Bromus tectorum</i>	cheat grass
	<i>Poa sandbergii</i>	Sandberg's bluegrass
Polemoniaceae	<i>Phlox hoodii</i>	Hood's phlox

## **Fixed-Point Avian Use Surveys**

A total of 57 species were identified during the point counts, in-transit travel and incidentally while conducting other field tasks at Zintel Canyon and Nine Canyon (Table 4). This section summarizes results of the fixed-point surveys conducted from April 4, 2001 through March 25, 2002 on Zintel Canyon.

### Avian Diversity

A total of 312 30-minute point count surveys were conducted on the Zintel Canyon Wind Project Site from April 4, 2001 through March 25, 2002 (Table 5). A total of 39 species were observed during the fixed-point surveys at Zintel Canyon. The mean number of species observed per survey (30-minute point count) was 2.44, which is similar to the estimate for Nine Canyon (2.36/survey).

### Avian Use by Species

A total of 6,269 individual bird detections within 1,385 separate groups were recorded from April 4, 2001 through March 25, 2002 (Table 6) during the fixed-point surveys. Over 77% of the observations were of horned larks (2439) and Canada geese (2436). Other species comprising at least one percent of the total observations included western meadowlark (9.3%), sandhill crane (3.2%), common raven (2.4%) and ring-necked pheasant (1.4%).

Mean use estimates (number of birds/30-minute survey) were calculated (using detections within 800 m of each point) by species and season, and grouped by bird size due to differences in the detectability of small and large birds (Table 7). Ring-necked pheasant (0.35), common raven (0.26), northern harrier (0.12), American kestrel (0.12) and Swainson's hawk (0.10) were the five large bird species with the highest summer use. The small bird species with the highest summer use were horned lark (2.50), western meadowlark (2.18), mourning dove (0.12), western kingbird (0.12), tree swallow (0.08), unidentified swallow (0.07) and Say's Phoebe (0.06), with one other species recorded twice.

During the fall, the five large bird species with the highest use included sandhill crane (2.38), Canada goose (1.77, mostly due to two large groups), common raven (0.83), American kestrel (0.41), and red-tailed hawk (0.23). Small bird abundance in the fall was again dominated by horned lark (3.06), and western meadowlark (1.70), followed by white-crowned sparrow (0.09), barn swallow (0.06) and savannah sparrow (0.06).

**Table 4. List of avian species observed during fixed-point and in-transit surveys on the Nine Canyon and Zintel Canyon Project sites.**

<b>Species/Group</b>	<b>Scientific Name</b>	<b>Species/Group</b>	<b>Scientific Name</b>
American goldfinch <sup>a</sup>	<i>Carduelis tristis</i>	red-tailed hawk	<i>Buteo jamaicensis</i>
American kestrel	<i>Falco sparverius</i>	red-winged blackbird <sup>b</sup>	<i>Agelaius phoeniceus</i>
American pipit <sup>a</sup>	<i>Anthus rebenscens</i>	ring-billed gull	<i>Larus delawarensis</i>
American robin	<i>Turdus migratorius</i>	ring-necked pheasant	<i>Phasianus colchicus</i>
barn swallow	<i>Hirundo rustica</i>	rock dove	<i>Columa livia</i>
black-billed magpie <sup>b</sup>	<i>Pica pica</i>	rock wren <sup>b</sup>	<i>Salpinctes obsoletus</i>
Brewer's blackbird <sup>a</sup>	<i>Euphagus cyanocephalus</i>	rough-legged hawk	<i>Buteo lagopus</i>
Brewer's sparrow <sup>b</sup>	<i>Spizella breweri</i>	sage thrasher <sup>b</sup>	<i>Oreoscoptes montanus</i>
California quail <sup>b</sup>	<i>Callipepla californica</i>	sandhill crane	<i>Grus canadensis</i>
Canada goose	<i>Branta canadensis</i>	savannah sparrow	<i>Passerculus sandwichensis</i>
chukar	<i>Alectoris chukar</i>	Say's phoebe	<i>Sayornis saya</i>
cliff swallow	<i>Petrochelidon pyrrhonota</i>	sharp-shinned hawk <sup>b</sup>	<i>Accipiter striatus</i>
common raven	<i>Corvus corax</i>	short-eared owl	<i>Asio flammeus</i>
dark-eyed junco <sup>b</sup>	<i>Junco hyemalis</i>	Swainson's hawk	<i>Buteo swainsoni</i>
double-crested cormorant <sup>a</sup>	<i>Phalacrocorax auritus</i>	tree swallow <sup>b</sup>	<i>Tachycineta bicolor</i>
eastern kingbird	<i>Tyrannus tyrannus</i>	varied thrush <sup>a</sup>	<i>Ixoreus naevius</i>
European starling	<i>Sturnus vulgaris</i>	Vaux's swift <sup>a</sup>	<i>Chaetura vauxi</i>
ferruginous hawk <sup>a</sup>	<i>Buteo regalis</i>	vesper sparrow	<i>Poocetes gramineus</i>
golden eagle <sup>a</sup>	<i>Aquila chrysaetos</i>	violet-green swallow <sup>b</sup>	<i>Tachycineta thalassina</i>
grasshopper sparrow	<i>Ammodramus savannarum</i>	western kingbird <sup>b</sup>	<i>Tyrannus verticalis</i>
gray partridge	<i>Perdix perdix</i>	western meadowlark	<i>Sturnella neglecta</i>
gray-crowned rosy finch <sup>b</sup>	<i>Leucosticte arctoa</i>	white-crowned sparrow <sup>b</sup>	<i>Zonotrichia leucophrys</i>
great blue heron	<i>Ardea herodias</i>	winter wren	<i>Troglodytes troglodytes</i>
great horned owl	<i>Bubo virginianus</i>	unidentified bird	
horned lark	<i>Eremophila alpestris</i>	unidentified buteo	
house finch	<i>Carpodacus mexicanus</i>	unidentified eagle	
loggerhead shrike	<i>Lanius ludovicianus</i>	unidentified gull	
merlin	<i>Falco columbarius</i>	unidentified passerine	
mountain bluebird <sup>b</sup>	<i>Sialia currucoides</i>	unidentified shrike	
mourning dove	<i>Zenaida macroura</i>	unidentified sparrow	
northern harrier	<i>Circus cyaneus</i>	unidentified swallow	
northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>		
northern shrike	<i>Lanius excubitor</i>		
prairie falcon	<i>Falco mexicanus</i>		

<sup>a</sup> observed during the Nine Canyon study only

<sup>b</sup> observed during the Zintel Canyon study only

**Table 5. Mean use, mean # species/survey, total number of species and total number of fixed-point surveys conducted by season and overall for the Zintel Canyon Project site.**

<b>Season</b>	<b>Number of visits</b>	<b>Mean Use<sup>a</sup></b>	<b># Species/Survey<sup>b</sup></b>	<b># Species</b>	<b># Surveys Conducted</b>
Summer	14	6.75	2.31	18	84
Fall	11	12.68	2.64	26	66
Winter	19	39.66	2.12	16	114
Spring	8	9.20	3.13	22	48
<b>Overall</b>	<b>52</b>	<b>19.80</b>	<b>2.44</b>	<b>39</b>	<b>312</b>

<sup>a</sup> # observations per 30-minute survey

<sup>b</sup> # unique species observed per 30-minute survey

**Table 6. Avian species observed while conducting fixed-point surveys (April 24, 2001 – March 25, 2002) on the Zintel Canyon Wind Project site. <sup>a</sup>**

Species/Group	Summer		Fall		Winter		Spring		Grand Total	
	#	#	#	#	#	#	#	#	#	#
	obs.	groups	obs.	groups	obs.	groups	obs.	groups	obs.	groups
<b>Waterbirds</b>										
ring-billed gull	1	1	0	0	0	0	3	3	4	4
unidentified gull	0	0	0	0	0	0	6	3	6	3
great blue heron	2	1	0	0	0	0	0	0	2	1
sandhill crane	0	0	168	4	0	0	34	1	202	5
Subtotal	3	2	168	4	0	0	43	7	214	13
<b>Waterfowl</b>										
Canada goose	0	0	117	3	2319	15	0	0	2436	18
<b>Upland Gamebirds</b>										
California quail	2	2	2	2	0	0	4	2	8	6
gray (Hungarian) partridge	1	1	5	1	5	1	0	0	11	3
ring-necked pheasant	30	30	13	4	10	7	26	26	79	67
Subtotal	33	33	20	7	15	8	30	28	98	76
<b>Doves</b>										
mourning dove	10	9	0	0	0	0	3	2	13	11
<b>Raptors</b>										
<b>Accipiter</b>										
sharp-shinned hawk	1	1	0	0	0	0	1	1	2	2
<b>Buteos</b>										
red-tailed hawk	7	7	16	15	14	13	3	3	40	38
Swainson's hawk	9	8	3	3	0	0	1	1	13	12
rough-legged hawk	0	0	8	8	36	33	9	9	53	50
unidentified buteo	2	2	8	7	8	8	7	6	25	23
Subtotal	18	17	35	33	58	54	20	19	131	123
<b>Eagles</b>										
unidentified eagle	0	0	0	0	1	1	0	0	1	1
<b>Falcons</b>										
prairie falcon	0	0	2	2	2	2	1	1	5	5
merlin	0	0	1	1	1	1	0	0	2	2
American kestrel	10	6	28	24	9	8	2	2	49	40
Subtotal	10	6	31	27	12	11	3	3	56	47
<b>Other Raptors</b>										
northern harrier	12	11	7	7	18	17	6	6	43	41
Raptor Subtotal	36	31	82	75	85	79	27	26	230	211

<sup>a</sup> Includes observations recorded at distances greater than 800 m from the observer.

**Table 6 (continued). Avian species observed while conducting fixed-point surveys (April 24, 2001 – March 25, 2002) on the Zintel Canyon Wind Project site.<sup>a</sup>**

Species/Group	Summer		Fall		Winter		Spring		Grand Total	
	# obs.	# groups	# obs.	# groups						
<b>Passerines</b>										
eastern kingbird	0	0	0	0	0	0	1	1	1	1
western kingbird	10	8	2	2	0	0	0	0	12	10
Say's phoebe	5	5	0	0	0	0	0	0	5	5
horned lark	211	179	202	47	1855	149	171	123	2439	498
black-billed magpie	0	0	9	3	0	0	0	0	9	3
common raven	30	20	55	20	31	20	32	27	148	87
European starling	0	0	0	0	0	0	3	1	3	1
western meadowlark	184	182	112	51	174	78	115	98	585	409
house finch	0	0	0	0	0	0	3	1	3	1
gray-crowned rosy finch	0	0	0	0	8	1	0	0	8	1
vesper sparrow	0	0	1	1	0	0	0	0	1	1
savannah sparrow	0	0	4	1	0	0	0	0	4	1
white-crowned sparrow	0	0	6	2	1	1	7	4	14	7
dark-eyed junco	0	0	2	2	2	1	0	0	4	3
unidentified sparrow	0	0	1	1	0	0	0	0	1	1
barn swallow	0	0	4	2	0	0	0	0	4	2
tree swallow	7	2	0	0	0	0	0	0	7	2
violet-green swallow	0	0	0	0	0	0	3	1	3	1
northern rough-winged swallow	2	1	0	0	0	0	0	0	2	1
unidentified swallow	6	3	1	1	0	0	1	1	8	5
northern shrike	0	0	0	0	1	1	0	0	1	1
loggerhead shrike	0	0	2	2	0	0	1	1	3	3
winter wren	0	0	1	1	0	0	0	0	1	1
American robin	0	0	3	2	0	0	1	1	4	3
mountain bluebird	0	0	1	1	0	0	0	0	1	1
Subtotal	455	400	409	142	2072	251	338	259	3274	1052
<b>Other</b>										
unidentified bird	1	1	0	0	0	0	0	0	1	1
Grand Total	543	480	787	223	4495	357	444	325	6269	1385

<sup>a</sup> Includes observations recorded at distances greater than 800 m from the observer.

**Table 7. Avian species observed within 800 m of observer and estimated mean use for large and small birds on the Zintel Canyon Wind Project Site (April 24, 2001 – March 25, 2002).**

<u>Summer</u>		<u>Fall</u>		<u>Large Birds</u>		<u>Winter</u>		<u>Spring</u>	
Species/Group	Use <sup>a</sup>	Species/Group	Use	Species/Group	Use	Species/Group	Use	Species/Group	Use
ring-necked pheasant	0.35	sandhill crane	2.38	Canada goose	20.34	sandhill crane	0.71		
common raven	0.26	Canada goose	1.77	rough-legged hawk	0.20	common raven	0.54		
northern harrier	0.12	common raven	0.83	common raven	0.20	ring-necked pheasant	0.52		
American kestrel	0.12	American kestrel	0.41	northern harrier	0.13	rough-legged hawk	0.10		
Swainson's hawk	0.10	red-tailed hawk	0.23	red-tailed hawk	0.11	northern harrier	0.10		
red-tailed hawk	0.08	ring-necked pheasant	0.20	ring-necked pheasant	0.09	California quail	0.08		
great blue heron	0.02	black-billed magpie	0.14	American kestrel	0.08	ring-billed gull	0.06		
California quail	0.02	rough-legged hawk	0.11	gray (Hungarian) partridge	0.04	unidentified gull	0.06		
unidentified buteo	0.02	northern harrier	0.11	prairie falcon	0.02	red-tailed hawk	0.06		
ring-billed gull	0.01	gray (Hungarian) partridge	0.08	unidentified buteo	0.01	American kestrel	0.04		
gray (hungarian) partridge	0.01	unidentified buteo	0.08	merlin	0.01	prairie falcon	0.02		
sharp-shinned hawk	0.01	Swainson's hawk	0.05	unidentified eagle	0.01	sharp-shinned hawk	0.02		
		California quail	0.03			unidentified buteo	0.02		
		prairie falcon	0.03			Swainson's hawk	0.02		
		merlin	0.01						

<sup>a</sup> # observations per 30-minute survey

**Table 7 (continued). Avian species observed within 800 m of observer and estimated mean use for large and small birds on the Zintel Canyon Wind Project Site (April 24, 2001 – March 25, 2002).**

<u>Summer</u>		<u>Fall</u>		<u>Small Birds</u>		<u>Spring</u>	
Species/Group	Use <sup>a</sup>	Species/Group	Use	Species/Group	Use	Species/Group	Use
horned lark	2.50	horned lark	3.06	horned lark	16.23	horned lark	3.56
western meadowlark	2.18	western meadowlark	1.70	western meadowlark	1.53	western meadowlark	2.40
mourning dove	0.12	white-crowned sparrow	0.09	gray-crowned rosy finch	0.07	white-crowned sparrow	0.15
western kingbird	0.12	barn swallow	0.06	dark-eyed junco	0.02	mourning dove	0.06
tree swallow	0.08	savannah sparrow	0.06	white-crowned sparrow	0.01	house finch	0.06
unidentified swallow	0.07	American robin	0.05	northern shrike	0.01	violet-green swallow	0.06
say's phoebe	0.06	unidentified passerine	0.05			European starling	0.06
northern rough-winged swallow	0.02	dark-eyed junco	0.03			loggerhead shrike	0.02
		western kingbird	0.03			American robin	0.02
		loggerhead shrike	0.03			eastern kingbird	0.02
		unidentified swallow	0.02			unidentified swallow	0.02
		unidentified sparrow	0.02				
		winter wren	0.02				
		mountain bluebird	0.02				
		vesper sparrow	0.02				

<sup>a</sup> # observations per 30-minute survey

During the winter, the large birds with the highest use were Canada goose (20.34), due to eight groups observed, followed by rough-legged hawk (0.20), common raven (0.20), northern harrier (0.13), red-tailed hawk (0.11) and ring-necked pheasant (0.09). During the winter, only four small bird species were observed more than once within plot boundaries: horned lark (16.23), western meadowlark (1.53), gray-crowned rosy finch (0.07) and dark-eyed junco (0.02).

During the spring, the large birds with the highest use were sandhill crane (0.71), common raven (0.54), ring-necked pheasant (0.52), rough-legged hawk (0.10), northern harrier (0.10) and California quail (0.08). Once again, horned lark (3.56) and western meadowlark (2.40) comprised most of the small bird use, followed by white-crowned sparrow (0.15).

### Frequency of Occurrence by Species

Table 8 contains the estimated frequency of occurrence by species and season. This parameter measures how often a species is observed during 30-minute point count surveys (% of surveys). During the summer, ring-necked pheasant had the highest frequency of occurrence (19.0%) for large birds, followed by northern harrier (9.5%), common raven (9.5%), red-tailed hawk (7.1%), American kestrel (6.0%) and Swainson's hawk (6.0%). Small bird species observed during more than five percent of the surveys were horned lark (69.0%), western meadowlark (59.5%), mourning dove (9.5%), western kingbird (8.3%) and Say's phoebe (6.0%).

During the fall, common raven (28.8%), American kestrel (25.8%), red-tailed hawk (16.7%), northern harrier (10.6%), rough-legged hawk (7.6%), unidentified buteo (7.6%) and ring-necked pheasant (6.1%) were the large bird species observed during more than five percent of the surveys, while horned lark (48.5%) and western meadowlark (48.5%) were the only small birds observed at this level.

During the winter, rough-legged hawk (16.7%), common raven (11.4%), northern harrier (10.5%), red-tailed hawk (8.8%), Canada goose (7.9%), American kestrel (7%) and ring-necked pheasant (5.3%) were observed during more than five percent of the surveys. Horned lark (69.3%) and western meadowlark (43.9%) were the only small bird species identified during more than five percent of the winter surveys.

During the spring, common raven (35.4%), ring-necked pheasant (25.0%), northern harrier (10.4%), rough-legged hawk (8.3%), ring-billed gull (6.3%) and red-tailed hawk (6.3%) were observed during more than five percent of the surveys. Horned lark (85.4%), western meadowlark (60.4%) and white-crowned sparrow (6.3%) were the only small bird species identified during more than five percent of the spring surveys.

**Table 8. Avian species observed within 800 m of observer and estimated frequency of occurrence for large and small birds on the Zintel Canyon Project site (April 24, 2001 – March 25, 2002).**

<u>Summer</u>		<u>Fall</u>		<u>Large Birds</u>		<u>Winter</u>		<u>Spring</u>	
Species/Group	% freq. <sup>a</sup>	Species/Group	% freq.	Species/Group	% freq.	Species/Group	% freq.	Species/Group	% freq.
ring-necked pheasant	19.0	common raven	28.8	rough-legged hawk	16.7	common raven	35.4		
northern harrier	9.5	American kestrel	25.8	common raven	11.4	ring-necked pheasant	25.0		
common raven	9.5	red-tailed hawk	16.7	northern harrier	10.5	northern harrier	10.4		
red-tailed hawk	7.1	northern harrier	10.6	red-tailed hawk	8.8	rough-legged hawk	8.3		
American kestrel	6.0	rough-legged hawk	7.6	Canada goose	7.9	ring-billed gull	6.3		
Swainson's hawk	6.0	unidentified buteo	7.6	American kestrel	7.0	red-tailed hawk	6.3		
California quail	2.4	ring-necked pheasant	6.1	ring-necked pheasant	5.3	unidentified gull	4.2		
great blue heron	1.2	sandhill crane	4.5	prairie falcon	1.8	California quail	4.2		
ring-billed gull	1.2	Canada goose	4.5	gray (Hungarian) partridge	0.9	American kestrel	4.2		
gray (hungarian) partridge	1.2	Swainson's hawk	4.5	Unidentified buteo	0.9	sandhill crane	2.1		
unidentified buteo	1.2	black-billed magpie	4.5	merlin	0.9	prairie falcon	2.1		
sharp-shinned hawk	1.2	California quail	3.0	Unidentified eagle	0.9	sharp-shinned hawk	2.1		
		prairie falcon	3.0			unidentified buteo	2.1		
		gray (Hungarian) partridge	1.5			Swainson's hawk	2.1		
		merlin	1.5						

<sup>a</sup> % of 30-minute surveys species/group is recorded

**Table 8 (continued). Avian species observed within 800 m of observer and estimated frequency of occurrence for large and small birds on the Zintel Canyon Project site (April 24, 2001 – March 25, 2002).**

<u>Summer</u>		<u>Fall</u>		<u>Small Birds</u>		<u>Winter</u>		<u>Spring</u>	
Species/Group	% freq.	Species/Group	% freq.	Species/Group	% freq.	Species/Group	% freq.	Species/Group	% freq.
horned lark	69.0	horned lark	48.5	horned lark	69.3	horned lark	85.4		
western meadowlark	59.5	western meadowlark	48.5	western meadowlark	43.9	western meadowlark	60.4		
mourning dove	9.5			gray-crowned rosy finch	0.9	white-crowned sparrow	6.3		
western kingbird	8.3	white-crowned sparrow	3.0	dark-eyed junco	0.9	mourning dove	4.2		
Say's phoebe	6.0	barn swallow	3.0	white-crowned sparrow	0.9	house finch	2.1		
tree swallow	2.4	American robin	3.0	northern shrike	0.9	violet-green swallow	2.1		
unidentified swallow	2.4	western kingbird	3.0			European starling	2.1		
northern rough-winged swallow	1.2	loggerhead shrike	3.0			loggerhead shrike	2.1		
		savannah sparrow	1.5			American robin	2.1		
		unidentified passerine	1.5			eastern kingbird	2.1		
		dark-eyed junco	1.5			unidentified swallow	2.1		
		unidentified swallow	1.5						
		unidentified sparrow	1.5						
		winter wren	1.5						
		mountain bluebird	1.5						
		vesper sparrow	1.5						

### Avian Use by Seasons and Groups

Mean use data by season and avian group are presented in Table 9. Relatively similar overall avian use occurred in the fall (12.68), spring (9.20), with slightly lower summer use (6.75), and much higher winter use (39.66) (Figure 6). The apparent higher use in winter was primarily due to observations of relatively large flocks of birds (i.e., 1100 Canada geese and 105 horned larks).

*Passerines* - Passerines were the most abundant avian group observed during all seasons except winter when waterfowl (Canada geese) were more abundant. Passerines showed similar abundance in fall (6.20), summer (5.30) and spring (6.92) with significantly higher use in winter (18.06), primarily due to one large flock of horned larks (Figure 6). Passerines made up at least 46.0% of the avian use in any season, and 84% of the use in the summer. Passerines were observed during 93.8% of the surveys in the spring, 88.6% of the surveys in the winter, 86.4% in the fall, and 84.5% in the summer.

*Raptors* - Raptor use was second highest to passerines in the summer (0.45), fourth to passerines, waterbird, and waterfowl in the fall (1.02) and spring (0.40) and third to passerines and waterfowl in the winter (0.56) (Figure 6). Raptor use was highest in the fall with American kestrels the most abundant species, followed by the winter, with rough-legged hawks being the most common observed raptor. In all seasons, raptors made up less than nine percent of the avian use, and were observed between 11% (spring) and 33% (winter) of the surveys.

*Waterfowl* - The majority of waterfowl use occurred in the winter, and consisted of several groups of Canada geese.

*Waterbird* - The majority of waterbird use occurred in the fall, and consisted of a few groups of sandhill cranes.

*Other Groups* - The only other avian group with an estimated use greater than or equal to 0.10/survey during all seasons was upland gamebirds based on observations of ring-necked pheasants and occasional California quail and gray partridge.

**Table 9. Mean use, percent composition and percent frequency of occurrence for avian groups by season for the Zintel Canyon Wind Project site.**

<b><u>Mean Use (#/30 minute survey)</u></b>				
<b>Species/Group</b>	<b>Summer</b>	<b>Fall</b>	<b>Winter</b>	<b>Spring</b>
Waterbird	0.036	2.379	0.000	0.833
Waterfowl	0.000	1.773	20.342	0.000
Upland Gamebird	0.381	0.303	0.132	0.604
Dove	0.119	0.000	0.000	0.063
Eagle	0.000	0.000	0.009	0.000
Falcon	0.119	0.455	0.105	0.063
Other-Raptor	0.119	0.106	0.132	0.104
Accipiter	0.012	0.000	0.000	0.021
Buteo	0.202	0.455	0.316	0.208
Raptors subtotal	0.452	1.015	0.561	0.396
Passerines	5.298	6.197	18.061	6.917
Other	0.012	0.000	0.000	0.000
<b>Subtotal</b>	<b>6.750</b>	<b>12.682</b>	<b>39.658</b>	<b>9.208</b>
<b><u>Group Composition (%)</u></b>				
<b>Species/Group</b>	<b>Summer</b>	<b>Fall</b>	<b>Winter</b>	<b>Spring</b>
Waterbird	0.6	20.4	0.0	9.5
Waterfowl	0.0	15.2	52.0	0.0
Upland Gamebird	6.0	2.6	0.3	6.9
Dove	1.9	0.0	0.0	0.7
Eagle	0.0	0.0	0.0	0.0
Falcon	1.9	3.9	0.3	0.7
Other-Raptor	1.9	0.9	0.3	1.2
Accipiter	0.2	0.0	0.0	0.2
Buteo	3.2	3.9	0.8	2.4
Raptor - Subtotal	7.2	8.7	1.4	4.5
Passerines	84.1	53.1	46.2	78.5
Other	0.2	0.0	0.0	0.0
<b><u>% Frequency</u></b>				
<b>Species/Group</b>	<b>Summer</b>	<b>Fall</b>	<b>Winter</b>	<b>Spring</b>
Waterbird	2.4	4.5	0.0	12.5
Waterfowl	0.0	4.5	7.9	0.0
Upland Gamebird	21.4	9.1	5.3	29.2
Dove	9.5	0.0	0.0	4.2
Eagle	0.0	0.0	0.9	0.0
Falcon	6.0	28.8	9.6	6.3
Other-Raptor	9.5	10.6	10.5	10.4
Accipiter	1.2	0.0	0.0	2.1
Buteo	11.9	33.3	25.4	18.8
Raptor - Subtotal	23.1	21.2	32.7	11.5
Passerines	84.5	86.4	88.6	93.8
Other	1.2	0.0	0.0	0.0

### Flight Height Characteristics

At least 10 flocks of flying birds were observed for ten species during the fixed-point surveys. Of these species, rough-legged hawk (46.0%), Swainson's hawk (45.5%), red-tailed hawk (43.5%) and common raven (37.5%) were most often observed within the RSA. Smaller passerines including horned lark (6.4%) and western meadowlark (0%) were not often observed within the RSA (Table 10).

Overall, 5.8% of the birds observed were recorded within the RSA of the Bonus turbine, 44.9% were below the RSA and 49.3% were flying above the RSA (Table 11). Raptors had the highest percentage of observations with the RSA (31.4%). Raptor groups observed above this mean (31.4) included eagles (100.0%), accipiters (100%) and buteos (42.3%), while falcons (20.0%; primarily kestrels) and other raptors (9.8%; northern harriers) were often observed below the RSA. Passerines, waterfowl, and waterbirds were not typically observed within the RSA. Passerines were typically observed below the RSA, while waterfowl and waterbirds were typically observed above the RSA.

Table 12 contains comparative mean use estimates for several different wind developments. Results are standardized to a 20-minute survey based on the assumption of equal use throughout the survey period. The Zintel Canyon Wind Project Site had lower observed raptor use than Nine Canyon, Vansycle, Stateline, Klondike, Buffalo Ridge, and Foote Creek Rim estimates for the spring season and was similar to those projects in the summer and winter. Fall use was higher at Zintel Canyon than at all project areas except Foote Creek Rim in the fall, primarily due to observations of kestrels and harriers. Only one raptor fatality was recorded during a 4-year study at the Buffalo Ridge Wind Plant (~450 turbines) (Johnson *et al.* 2000a). Five raptor fatalities were recorded over a two-year period at the Foote Creek Rim Phase I wind plant (69 turbines) in Wyoming (Johnson *et al.* 2001), where there is much higher average raptor use than at the other sites reported, including Zintel Canyon. No raptor fatalities have been observed at Klondike based on five months of surveys, and Vansycle based on 12 months of surveys (Erickson *et al.* 2000). Two raptor fatalities (both red-tailed hawks) have been observed at Stateline between July 2001 and May 2002, based on over 1000 turbine searches.

**Table 10. Flight height characteristics by species observed during fixed-point surveys.**

Species/Group	# groups flying	# birds flying	% birds flying	Bonus 1.3 MW (29-91 m AGL)		
				below	within	above
American kestrel	28	33	67.3	81.8	18.2	0.0
American robin	2	3	75.0	100.0	0.0	0.0
barn swallow	2	4	100.0	100.0	0.0	0.0
black-billed magpie	3	9	100.0	100.0	0.0	0.0
California quail	0	0	0.0	N/A	N/A	N/A
Canada goose	16	2421	99.4	0.0	2.4	97.6
common raven	73	128	86.5	54.7	37.5	7.8
dark-eyed junco	2	3	75.0	100.0	0.0	0.0
eastern kingbird	1	1	100.0	100.0	0.0	0.0
European starling	0	0	0.0	N/A	N/A	N/A
gray (Hungarian) partridge	0	0	0.0	N/A	N/A	N/A
gray-crowned rosy finch	0	0	0.0	N/A	N/A	N/A
great blue heron	1	2	100.0	0.0	100.0	0.0
Horned lark	275	2181	89.4	93.6	6.4	0.0
house finch	1	3	100.0	0.0	0.0	100.0
loggerhead shrike	3	3	100.0	100.0	0.0	0.0
Merlin	2	2	100.0	100.0	0.0	0.0
mountain bluebird	1	1	100.0	100.0	0.0	0.0
mourning dove	4	6	46.2	100.0	0.0	0.0
northern harrier	39	41	95.3	85.4	9.8	4.9
northern rough-winged swallow	1	2	100.0	100.0	0.0	0.0
northern shrike	0	0	0.0	N/A	N/A	N/A
prairie falcon	5	5	100.0	60.0	40.0	0.0
red-tailed hawk	21	23	57.5	30.4	43.5	26.1
ring-billed gull	4	4	100.0	50.0	0.0	50.0
ring-necked pheasant	3	15	19.0	100.0	0.0	0.0
rough-legged hawk	47	50	94.3	22.0	46.0	32.0
sandhill crane	5	202	100.0	0.0	0.0	100.0
savannah sparrow	1	4	100.0	100.0	0.0	0.0
Say's phoebe	3	3	60.0	100.0	0.0	0.0
sharp-shinned hawk	2	2	100.0	0.0	100.0	0.0
Swainson's hawk	11	11	84.6	45.5	45.5	9.1
tree swallow	2	7	100.0	100.0	0.0	0.0
vesper sparrow	1	1	100.0	100.0	0.0	0.0
violet-green swallow	1	3	100.0	100.0	0.0	0.0
western kingbird	5	6	50.0	100.0	0.0	0.0
western meadowlark	40	82	14.0	100.0	0.0	0.0
white-crowned sparrow	5	11	78.6	100.0	0.0	0.0
Winter wren	1	1	100.0	100.0	0.0	0.0
unidentified bird	1	1	100.0	100.0	0.0	0.0
unidentified buteo	15	17	68.0	11.8	29.4	58.8
unidentified eagle	1	1	100.0	0.0	100.0	0.0
unidentified gull	3	6	100.0	66.7	33.3	0.0
unidentified passerine	3	3	100.0	0.0	33.3	66.7
unidentified sparrow	1	1	100.0	0.0	100.0	0.0
unidentified swallow	5	8	100.0	100.0	0.0	0.0
<b>Subtotal</b>	<b>640</b>	<b>5310</b>	<b>84.7</b>	<b>44.9</b>	<b>5.8</b>	<b>49.3</b>

**Table 11. Flight height characteristics by avian group during fixed-point surveys.**

<b>Group</b>	<b># flocks flying</b>	<b># birds flying</b>	<b>% birds flying</b>	<b>Bonus 1.3 MW (29-91 m AGL)</b>		
				<b>below</b>	<b>within</b>	<b>above</b>
Waterbird	13	214	100.0	2.8	1.9	95.3
Waterfowl	16	2421	99.4	0.0	2.4	97.6
Upland Gamebird	3	15	15.3	100.0	0.0	0.0
Dove	4	6	46.2	100.0	0.0	0.0
Accipiter	2	2	100.0	0.0	100.0	0.0
Buteo	94	101	77.1	24.8	42.6	32.7
Eagle	1	1	100.0	0.0	100.0	0.0
Falcon	35	40	71.4	80.0	20.0	0.0
Other-Raptor	39	41	95.3	85.4	9.8	4.9
All Raptors	171	185	80.3	49.8	31.4	18.9
Passerines	432	2468	75.4	91.7	7.7	0.6
Other	1	1	100.0	100.0	0.0	0.0
Subtotal	640	5310	84.7	44.9	5.8	49.3

**Table 12. Mean raptor use estimates standardized to 20 minutes from studies conducted at the Zintel Canyon Project, the Nine Canyon Project, the Buffalo Ridge Project, the Foote Creek Rim Project, the Klondike Project, the Stateline Project, and the Vansycle Project.**

Project	Raptor Use (estimated #/20 minute survey)			
	Summer	Fall	Winter	Spring
Zintel Canyon, WA	0.30	0.68	0.37	0.26
Nine Canyon, WA <sup>a</sup>	0.24	0.15	0.31	0.36
Buffalo Ridge MN <sup>b</sup>	0.45	0.56	ns <sup>f</sup>	0.49
Foote Creek Rim, WY <sup>c</sup>	0.75	0.96	0.21	0.49
Klondike, OR <sup>d</sup>	0.40	0.32	0.40	0.49
Stateline, OR/WA <sup>e</sup>	0.40	0.25	0.42	0.59
Vansycle Existing Wind Plant, OR <sup>e</sup>	0.27	0.20	0.78	0.67

<sup>a</sup>Erickson *et al.* (2001a)

<sup>b</sup>Johnson *et al.* (2000a)

<sup>c</sup>Johnson *et al.* (2000b)

<sup>d</sup>Johnson *et al.* (2002)

<sup>e</sup>Walla Walla County Regional Planning Department (2000)

<sup>f</sup>not surveyed

## Exposure Indices

Relative exposure indices (use multiplied by proportion of observations where bird flew within the rotor swept area) were calculated by species, and results are found in Table 13. This index is only based on flight height observations and relative abundance and does not account for other possible factors such as foraging behavior. The small bird species with the highest exposure index is horned lark. This species also had the highest exposure index at Stateline and Foote Creek Rim, and has been the most commonly observed fatality. The large bird species with the highest exposure index is Canada goose, followed by common raven and rough-legged hawk. Mortality studies at other wind plants have indicated that although ravens are often observed at wind plants within the zone of risk, they appear to be less susceptible to collision with wind turbines than other similar size birds (e.g., raptors, waterfowl). Only one Canada goose fatality has been reported at wind plants in the U.S., and no rough-legged hawk mortality has been reported (Erickson *et al.* 2002).

## **In-transit Survey Data and Other Incidental Observations**

Table 14 contains a list of the species of concern observed during the in-transit surveys along with other incidental observations. The most abundant species recorded (# of observations) were American kestrel (38), followed by northern harrier (27), red-tailed hawk, rough legged-hawk and prairie falcon (10). Three species observed during in-transit surveys were not detected during the fixed-point surveys including great horned owl, rock wren and short-eared owl.

Figures 7-10 show the flight paths of raptors and other species of interest and perched raptor locations observed during fixed-point and in-transit surveys. We discuss patterns, if they exist, for the more commonly observed species. Red-tailed hawks were most often observed nearest the three most northern observation stations (E, F and G, Figure 7). They were often observed perched and flying near the transmission lines within the boundary of station F. They were also often observed contour flying on the north slope of the ridge south of station E. They were also often observed near the intersection of Owens and Jump Off Joe Road near station G. Rough-legged hawks were observed throughout the study area during the winter months (Figure 7).

Northern harriers were more often observed at the observation stations located in the southern portion of the study area (H, I, J, Figure 8). American kestrels were observed throughout the study area, but based on visual interpretation of Figure 9, were observed at higher rates near station F near the transmission lines. The few prairie falcon observations were located throughout the study area. All but station H showed some Canada goose use within the station boundaries.

**Table 13. Mean exposure indices calculated by species observed during fixed-point surveys at the Zintel Canyon Project Site.**

<b>Species/Group</b>	<b>Overall mean use</b>	<b>% flying</b>	<b>% flying within RSA</b>	<b>Exposure Index</b>
Canada goose	7.808	99.4	2.4	0.183
horned lark	7.798	89.4	6.4	0.448
western meadowlark	1.872	14.0	0.0	0.000
sandhill crane	0.612	100.0	0.0	0.000
common raven	0.404	86.5	37.5	0.131
ring-necked pheasant	0.247	19.0	0.0	0.000
American kestrel	0.154	67.3	18.2	0.019
northern harrier	0.119	95.3	9.8	0.011
red-tailed hawk	0.119	57.5	43.5	0.030
rough-legged hawk	0.112	94.3	46.0	0.049
white-crowned sparrow	0.045	78.6	0.0	0.000
mourning dove	0.042	46.2	0.0	0.000
Swainson's hawk	0.038	84.6	45.5	0.015
western kingbird	0.038	50.0	0.0	0.000
gray (Hungarian) partridge	0.035	0.0	0.0	0.000
unidentified buteo	0.029	68.0	29.4	0.006
black-billed magpie	0.029	100.0	0.0	0.000
unidentified swallow	0.026	100.0	0.0	0.000
gray-crowned rosy finch	0.026	0.0	0.0	0.000
California quail	0.026	0.0	0.0	0.000
tree swallow	0.022	100.0	0.0	0.000
prairie falcon	0.016	100.0	40.0	0.006
Say's phoebe	0.016	60.0	0.0	0.000
savannah sparrow	0.013	100.0	0.0	0.000
American robin	0.013	75.0	0.0	0.000
barn swallow	0.013	100.0	0.0	0.000
ring-billed gull	0.013	100.0	0.0	0.000
dark-eyed junco	0.013	75.0	0.0	0.000
loggerhead shrike	0.010	100.0	0.0	0.000
unidentified gull	0.010	100.0	33.3	0.003
European starling	0.010	0.0	0.0	0.000
unidentified passerine	0.010	100.0	33.3	0.003
violet-green swallow	0.010	100.0	0.0	0.000
house finch	0.010	100.0	0.0	0.000
great blue heron	0.006	100.0	100.0	0.006
sharp-shinned hawk	0.006	100.0	100.0	0.006
northern rough-winged swallow	0.006	100.0	0.0	0.000
merlin	0.006	100.0	0.0	0.000
unidentified sparrow	0.003	100.0	100.0	0.003
unidentified eagle	0.003	100.0	100.0	0.003
eastern kingbird	0.003	100.0	0.0	0.000
northern shrike	0.003	0.0	0.0	0.000
winter wren	0.003	100.0	0.0	0.000
mountain bluebird	0.003	100.0	0.0	0.000
vesper sparrow	0.003	100.0	0.0	0.000
unidentified bird	0.003	100.0	0.0	0.000

**Table 14. Summary of observations of species of concern or species of local interest observed during fixed point surveys and in-transit surveys and other incidental observations.**

<b>Species</b>	<b># obs.</b>	<b># groups</b>
American kestrel	38	34
northern harrier	27	26
red-tailed hawk	22	22
rough-legged hawk	15	15
prairie falcon	10	10
unidentified shrike	8	8
Swainson's hawk	7	7
short-eared owl	4	2
California quail	4	1
loggerhead shrike	4	3
northern shrike	3	3
ring-necked pheasant	3	1
great horned owl	1	1
rock wren	1	1
ring-billed gull	1	1
<b>Subtotal</b>	<b>148</b>	<b>135</b>

## **Breeding Bird Surveys along Owens Road**

Results of the spring 2002 breeding bird surveys conducted along Owens Road are found in Table 15. Horned larks (32.4%) and western meadowlarks (26.3%) comprised over 50 percent of the observations. There were several species that were documented during these surveys that had not been documented during the fixed point surveys (Table 6) including Brewer's sparrow, cliff swallow, grasshopper sparrow, great horned owl and sage thrasher.

## **Raptor Nest Surveys**

Aerial raptor nest surveys of the Zintel Canyon site were conducted on April 28 and June 5, 2001. The survey area consisted of the Nine Canyon and Zintel Canyon Wind Project sites and an approximate 5-mile buffer (Figure 3). Raptor nesting activity was generally low, especially within two miles of both project areas (Table 16). A total of 18 active nests were identified, with an additional 22 inactive nests observed. There were six active Swainson's hawk nests, with the nearest nest approximately 2.0 miles northwest of the nearest proposed turbine string. Another Swainson's hawk nest was located approximately 2.3 miles south of a proposed turbine string. The other Swainson's hawk nests were all greater than 4 miles away from the nearest turbine string. Other active raptor nests identified were red-tailed hawk (4 all greater than 2.5 miles from nearest turbine), ferruginous hawk (1, approximately 3.5 miles from nearest turbine), and an American crow. Six active common raven nests were observed, with the nearest one located approximately 2 miles southwest of the nearest proposed turbine string. Ground visits to the previously active raptor nests nearest the Nine Canyon Project in 2002 verified activity at the Swainson's hawk nest and ferruginous hawk nest that are both located along Beck Road.

## **Burrowing Owl and Ground Squirrel Surveys**

No burrowing owls or evidence of their presence (e.g., pellets) were observed in grassland/shrub- steppe habitat located within 500 feet of the proposed turbine strings and roads.

At this time, turbines are proposed to be located in wheat fields, and there is very little suitable habitat for burrowing owls within 500 feet of the proposed turbine strings and roads. In addition, no burrowing owls have been observed at the Nine Canyon Project Site during the year-long avian surveys (Erickson *et al.* 2001a). Townsend's ground squirrel activity was documented at the proposed gravel quarry site.

**Table 15. Results of the 2002 Breeding bird surveys along Owens Road.**

Species	# observations	% composition	Mean Use <sup>a</sup>
horned lark	155	32.4	0.82
western meadowlark	126	26.3	0.51
house finch	34	7.1	0.48
ring-necked pheasant	28	5.8	0.05
western kingbird	25	5.2	0.33
rock wren	24	5.0	0.12
mourning dove	19	4.0	0.22
common raven	12	2.5	0.00
sage thrasher	8	1.7	0.05
vesper sparrow	8	1.7	0.00
California quail	6	1.3	0.00
European starling	5	1.0	0.08
unidentified swallow	5	1.0	0.00
Brewer's sparrow	4	0.8	0.02
American kestrel	3	0.6	0.03
cliff swallow	3	0.6	0.00
grasshopper sparrow	3	0.6	0.02
red-tailed hawk	2	0.4	0.00
red-winged blackbird	2	0.4	0.00
rock dove	2	0.4	0.00
unidentified raptor	2	0.4	0.00
American robin	1	0.2	0.03
great horned owl	1	0.2	0.02
Say's phoebe	1	0.2	0.00
Total	479	100.0	2.74

<sup>a</sup> # observations within 50-m of observer/10-minute survey (value of 0.00 indicates species observed outside 50-m plot boundary).

**Table 16. Summary of raptor observations from the helicopter surveys conducted in 2001 (April 28 and June 5).**

Nest	adult on nest	adult(s) in area	Eggs or Young	Species	Distance to Zintel turbine (miles)	Comments
Y	Y	Y	Y-3 young	CORA	3.5	Stick nest on powerline. First observed 2 <sup>nd</sup> visit, 3 young present.
Y	Y	Y	Y-2 young	CORA	4.0	Stick nest in cottonwood tree, 2 fledged young present during 2 <sup>nd</sup> visit.
Y	Y	Y	UNKN	CORA	2.1	Stick nest in cottonwood tree, no adults or young present during 2 <sup>nd</sup> visit.
Y	Y	Y	UNKN	CORA	6.9	Stick nest in cottonwood tree, no adults or young present during 2 <sup>nd</sup> visit
Y	Y	Y	UNKN	CORA	5.0	Stick nest in cottonwood tree, no adults or young present during 2 <sup>nd</sup> visit
Y	Y	Y	UNKN	CORA	7.2	Stick nest in cottonwood tree, 3 fully feathered young present during 2 <sup>nd</sup> visit
Y	Y	Y	UNKN	FEHA	3.5	Stick nest in locust tree. Bird incubating during 2 <sup>nd</sup> visit. Pair observed in 2002 as well.
Y	Y	Y	N	RTHA	2.8	Stick nest on powerline. Bird incubating the 1 <sup>st</sup> visit, but nest blown down 2 <sup>nd</sup> visit.
Y	Y	Y	N	RTHA	6.7	Stick nest in cottonwood. Bird incubating the 1 <sup>st</sup> visit, no adults or young present during 2 <sup>nd</sup> visit.
Y	Y	Y	Y-2 young	RTHA	2.7	stick nest on powerline. 2 young (50% feathered) during 2 <sup>nd</sup> visit.
Y	Y	Y	Y-2 young	RTHA	6.3	Stick nest on powerline. 2 young present during 2 <sup>nd</sup> visit.
Y	Y	Y	Y-3 young	SEOW/ AMCR	5.6	Stick nest on windmill. Occupied by SEOW during 1st visit. Occupied by AMCR 2 <sup>nd</sup> visit, with 3 young present.
Y	Y	Y	UNKN	SWHA	2.0	Bird incubating during 1 <sup>st</sup> and 2 <sup>nd</sup> visit.
Y	Y	Y	UNKN	SWHA	6.4	Bird incubating during 2 <sup>nd</sup> visit.
Y	Y	Y	UNKN	SWHA	5.0	Bird incubating during 2 <sup>nd</sup> visit.
Y	Y	Y	UNKN	SWHA	7.1	Bird incubating during 1 <sup>st</sup> and 2 <sup>nd</sup> visit.
Y	Y	Y	UNKN	SWHA	4.7	Bird incubating during 2 <sup>nd</sup> visit.
Y	Y	Y	UNKN	SWHA	2.3	Pair showed up after surveys. Pair observed in 2002 as well.

Y = Yes, N = No

AMCR=American crow, CORA=common raven, FEHA=ferruginous hawk, RTHA= red-tailed hawk, SEOW=short-eared owl, SWHA=Swainson's hawk, UNKN=unknown

## Nocturnal Migration

The following is a summary of results for the nocturnal migration study conducted by ABR Inc. at the adjacent Nine Canyon site during fall migration 2000 and spring migration 2001 using radar and visual observations (Mabee and Cooper 2000a, Mabee and Cooper 2001, Erickson *et al.* 2001a). Because of the proximity and similarity of habitat and elevations, these observations are judged applicable to the Zintel Canyon site. The sampling using the long-range setting includes the locations of nearly all the proposed Zintel Canyon turbines.

### Flight Direction and Migration Phenology

#### *Fall 2000*

Most of the targets detected on short- and long-range radar (mean  $\pm$  angular deviation) were flying southward ( $181 \pm 28^\circ$ ,  $n = 850$  targets;  $186 \pm 35^\circ$ ,  $n = 263$  targets, respectively). Migration rates of slow ( $\leq 56$  km/h; passerines and bats) and fast ( $> 56$  km/h; waterfowl, shorebirds, and some fast-flying bats) targets had large daily variation, and migration rates were highest during mid-September. Migration phenology of larger targets (e.g., waterfowl or flocked passerines) on long-range radar showed a similar pattern, with the highest migration rates occurring in late September. On a daily basis, the mean migration rates of slow and fast targets on short-range radar increased 1–2 hours after sunset and continued to rise over the course of the sampling period.

#### *Spring 2001*

At night, most of the targets detected on short- and long-range radar (mean  $\pm$  angular deviation) were flying northward ( $23 \pm 30^\circ$ ,  $n=536$  targets). Migration rates of all targets detected by the short-range radar were highly variable during the 9 days of sampling with the spring migration season, but the highest migration rates occurred during late April because of waterfowl and/or passerine movements. Migration phenology of larger targets on long-range radar showed relatively even patterns of migration intensity expected for a peak during late-April.

## Migration Movement Rates

### *Fall 2000*

Migration movement rates from the short-range radar were low-to-moderate at the Nine Canyon/Zintel Canyon site (Table 17). Daily movement rates also varied greatly among nights, ranging from 1–157 targets/hectare. Movement rates on long-range radar were also low at the Nine Canyon/Zintel Canyon site (Table 17). Similar to the pattern on short-range radar, migration rates were variable among nights on the long-range radar, ranging from 6–19 targets/hectare.

### *Spring 2001*

Relative to other nocturnal migration studies, movement rates in the spring from the short-range radar were moderate at the Nine Canyon/Zintel Canyon site (Table 17). Daily movement rates varied considerably within a season and increased substantially during late-April. Movement rates on long-range radar were also moderate. Migration rates from long-range radar were relatively uniform except during a peak in late-April.

## Flight Corridors

Small-scale differences in flight corridors were investigated by examining the number of targets passing east or west of the site during the fall 2000. On short-range radar, no differences were apparent for either slow or fast targets. In contrast, significantly more targets on long-range radar flew west of the Nine Canyon Project Site (Table 18). These comparisons were not conducted for the spring 2001 survey data.

## Flight Altitude

### *Fall 2000*

Collection of bird flight-altitude information was not always possible (especially during the early to mid-sampling periods) due to interference from insects (primarily moths). Overall, the mean nocturnal flight altitude ( $\pm 1$  SE) at Nine Canyon/Zintel Canyon was  $127 \pm 10$  m AGL ( $n = 46$  targets). Further, the limited data suggest that 54% of all targets in this area below 500 m flew between 0 and 100 m AGL (Table 19).

**Table 17. Mean nocturnal rates of movement (targets/h) of slow (passerines) and fast (waterfowl and shorebirds) targets observed during short-range radar sampling, and all targets observed during long-range sampling at the Nine Canyon/Zintel Canyon Project site, Washington, during fall 2000 and spring 2001.**

Radar/Target Type	Movement Rate (targets/hour)		
	Mean	SE	n <sup>a</sup>
<b><u>Fall 2000</u></b>			
<b><u>Short-Range</u></b>			
Slow	54.4	13.9	10
Fast	39.6	14.5	10
<b><u>Long-Range</u></b>			
All Targets	10.5	1.2	10
<b><u>Spring 2001</u></b>			
<b><u>Short-Range</u></b>			
All Targets	273.4	122.0	9
<b><u>Long-Range</u></b>			
All Targets	44.1	21.5	9

<sup>a</sup> number of sampling nights

**Table 18. Mean nocturnal rates of movement (targets/hour) of slow (passerines) and fast (waterfowl and shorebirds) targets observed during short-range radar sampling, and all targets observed during long-range radar sampling east and west of the Nine Canyon/Zintel Canyon Project site, Washington, during fall 2000.**

Radar/Target Type	Location	<u>Movement rate</u>			<u>Wilcoxon Signed-ranks test</u>		
		Mean	SE	n	Z	n	p
<b><u>Short-Range</u></b>							
Slow	East	22.3	7.0	10			
	West	29.0	7.0	10	-0.6	10	0.114
Fast	East	17.7	6.0	10			
	West	24.2	8.7	10	-1.4	10	0.153
<b><u>Long-Range</u></b>							
All Targets	East	3.6	0.9	10			
	West	6.8	0.7	10	-2.4	10	0.017

<sup>a</sup> number of sampling nights

**Table 19. Nocturnal flight altitudes of bird targets (% of all targets at a site) detected by vertical radar and night-vision equipment at the Nine Canyon Project site, Washington, during fall 2000 and spring 2001.<sup>a</sup>**

<b>Altitude (m AGL)</b>	<b>Nine Canyon/Zintel Canyon (%)</b>
<b><u>Fall 2000</u></b>	
0–50	8
51–100	46
101–150	26
151–200	10
201–250	6
251–300	2
301–350	0
351–400	0
401–500	2
<b><u>Spring 2001</u></b>	
0-100	14.4
101-200	11.7
201-300	11.3
301-400	6.3
401-500	5.9
501-600	32.6
601-700	3.6
701-800	3.1
801-900	2.5
901-1,000	1.7
1,001-1,500	2.2
1,501-2,000	3.3
2,001-2,500	1.3
2,501-3,000	0.1

<sup>a</sup> Methods used in 2001 were likely more accurate.

### *Spring 2001*

A substantial amount of flight altitude information on birds was collected during most nights using the new FR=1510 radar system. This system was not used in the fall. Mean nocturnal flight altitudes were highly variable during the sampling period, but were above the heights of the proposed wind turbines (~91 m) on any given night. Overall, ~14% of all targets flew between 0 and 100 m AGL (Table 19). The proportion of flight altitude targets steadily decreased over increasing 100 m altitude categories up to 500 m, where there was a notable increase of targets in this next interval. After 600 m, the proportion of flight altitude targets continued to decrease up to 3,000 m. The mean nocturnal flight altitude ( $\pm 1$  SE) was  $472 \pm 7$  m AGL at the Nine Canyon/Zintel Canyon site (n=3,093 targets).

### Comparisons to Other Sites

Overall, the mean movement rates of nocturnal migrants at this site fell within the average range of values from Alaska, South Dakota, Minnesota, and New York, where similar studies have been conducted (Mabee and Cooper 2001). Migration rates and flight altitudes were also similar to those recorded at the nearby Vansycle Wind-energy facility (with the exception of one night during the spring sampling) (Mabee and Cooper 2000b).

## **Threatened and Endangered Species, and Other Species of Concern, and Species/Groups of Local Interest**

A total of 19 federal and/or state-listed species<sup>1</sup> (two plants, four mammals, and 13 birds) and some high quality/priority habitats occur, or may occur, in the project area (Table 20). An additional five species (one mammal and four birds) were included in the analysis because of agency or other concerns, or because of their status as important prey for listed species. Of the listed species, the USFWS reported that one federally-listed threatened species and one candidate species could occur in the project vicinity (both are plants). No federally-listed endangered or proposed species were found in the vicinity of the project, and no critical habitat has been designated. The bald eagle is a federally-listed threatened species and the USFWS did include it on their list of species that may occur in the vicinity of the project. The bald eagle is also a State Threatened species and therefore was included in the analysis because of its potential occurrence in the nearby Columbia River. The remaining mammal and bird species and high quality/priority habitats are state-listed. Bats may occasionally forage in the project area and migrating bats may fly through the area during fall migration. Bat species with special status will be further discussed.

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<sup>1</sup> includes federal endangered, threatened, candidate and species of concern status, and state threatened, endangered, threatened and candidate status.

**Table 20. Federal and State Endangered, Threatened, and Special Status species and habitats occurring or potentially occurring in the Project Area and vicinity.**

Species/Ecosystem	Status	Habitat	Occurrence in Project Area and Vicinity
<b>Plants</b>			
Ute's ladies'-tresses <i>Spiranthes diluvialis</i>	Federal Threatened Species	Inhabits wetland and riparian areas, including spring habitats, and mesic to wet meadows, river meanders, and flood plains. In Washington, occurs at approximately 1,500 feet. (USFWS pers. comm.)	<b>Habitat for this species does not occur in the project area.</b> No wetlands, mesic to wet meadows, or water sources occur on site.
Untanum desert buckwheat <i>Eriogonum codium</i>	Federal Candidate Species	Known from one location on flat to gently sloping micro-sites near the top of steep north-facing basalt cliffs approximately 50 miles north of the project area at elevations ranging from 1,100 to 1,320 feet. May be restricted to the exposed top of the Lolo basalt flow (USFWS pers. comm.).	<b>Habitat for this species does not occur in the project area.</b> This species occurs on basalt cliffs (potentially one particular type of basalt flow) that are not found in the project area.
<b>Mammals</b>			
Yuma myotis <i>Myotis yumanensis</i>	Federal Species of Concern <sup>b</sup>	Associated very closely with water. Not much is known about the species in the Columbia Basin (Walla Walla County 2000).	<b>Not documented.</b> Unlikely to occur in the project area based on its association with water; could occur as a rare visitor.
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	Federal Species of Concern <sup>b</sup> State Candidate Species	Occurs in desert shrublands, pinyon-juniper woodlands, and dry coniferous forests. Roosts and hibernates in caves, abandoned mines, and buildings. Feeds on moths, flies, and beetles (Clark and Stromberg 1987).	<b>Not documented.</b> Unlikely to occur in the project area based on lack of roosting and hibernating sites; could occur as a rare visitor.
black-tailed jackrabbit <i>Lepus californicus</i>	State Candidate Species	Occurs in open prairies and sparsely vegetated deserts. Feeds on green vegetation (Burt and Grossenheider 1976).	<b>Not documented;</b> could occur in the project area based on suitable habitat.

**Table 20 (continued).**

<b>Species/Ecosystem</b>	<b>Status</b>	<b>Habitat</b>	<b>Occurrence in Project Area and Vicinity</b>
white-tailed jackrabbit <i>Lepus townsendii</i>	State Candidate Species	Occurs in open, grassy, or sagebrush plains. Feeds on grasses and other green vegetation in the summer and adds buds, bark, and small twigs in the winter (Burt and Grossenheider 1976).	<b>Not documented;</b> could occur in the project area based on suitable habitat.
Townsend's ground squirrel <i>Spermophilus townsendi</i>	Not listed on any federal or state species lists, but included here because they are the primary prey for ferruginous hawks.	Occurs in dry soils in sagebrush and grasslands. Feeds on vegetation and seeds, lives in burrows (Burt and Grossenheider 1976).	<b>Documented<sup>a</sup>.</b> Several observation made during 2001 incidentally along Owens Road and 2002 during surveys. Seen along Owens road in native habitat and near gravel quarry site.
<b>Birds</b>			
American white pelican <i>Pelecanus erythrorhynchos</i>	State Endangered Species	Inhabits lakes or rivers. May be found along the Columbia River during late winter and early spring. Feeds almost entirely on fish, nests on islands in freshwater lakes (Ennor 1991). Nests on Columbia River dredge islands near the Tri-Cities.	<b>Not documented.</b> Unlikely to be found on the project site, but could occur as a rare migrant or rarely may be found soaring over during local movements during the breeding season.
bald eagle <i>Haliaeetus leucocephalus</i>	Federal Threatened Species State Threatened Species	Feeds on fish and carrion, nests in trees or cliffs near water (Ennor 1991).	<b>Not documented.</b> One unidentified eagle (bald or golden) documented Uncommon winter visitor to Tri-Cities area, may be seen along the Columbia River from late October to early April. Could occur as a rare visitor to forage on carrion or small mammals.

**Table 20 (continued).**

Species/Ecosystem	Status	Habitat	Occurrence in Project Area and Vicinity
ferruginous hawk <i>Buteo regalis</i>	Federal Species of Concern <sup>b</sup> State Threatened Species	Occurs in open prairie habitat and commonly feeds on ground squirrels, rabbits, and hares. Nests in trees, cut banks, cliffs and rocky pinnacles (Ennor 1991).	<b>Documented<sup>a</sup></b> Three sitings during 2001 Nine Canyon avian use surveys (Erickson <i>et al.</i> 2001a). No sitings during Zintel Canyon avian use surveys. One active nest 3.5 miles to southwest of nearest turbine; 2 historic breeding locations documented within approx. 3 miles of project by the WDFW (based on reports from mid-1980's to mid-1990's.)
Swainson's hawk <i>Buteo swainsoni</i>	Not included on any federal or state species lists, but mentioned as a species of concern by agency biologists.	Occurs in arid regions from April to September, migrates to South America in the winter. Feeds on insects, small mammals, reptiles, amphibians, and birds. Nests in low trees or shrubs (Ennor 1991).	<b>Documented<sup>a</sup></b> . Twelve total observations (8 during fixed-point surveys in the summer, 4 in-transit observations). One active nest within 2.0 miles of proposed turbines and another around 2.3 miles from turbines. Four other active nests greater than 4 miles away from turbines. Two historic breeding locations within 3 miles of project facilities as reported by WDFW (based on reports from mid 1980's to early 1990's).
golden eagle <i>Aquila chrysaetos</i>	State Candidate Species	Breeds in hilly or mountainous areas, nests in rocky cliffs or isolated trees. Common prey species include ground squirrels, marmots, rabbits, and hares (Ennor 1991).	<b>Documented<sup>a</sup></b> . Documented during Nine Canyon surveys, not documented during Zintel Canyon surveys (although one unidentified eagle observation). Uncommon in the Tri-Cities area. Could occur in the project area as an occasional visitor in the winter months to forage for ground squirrels or other prey.

**Table 20 (continued).**

Species/Ecosystem	Status	Habitat	Occurrence in Project Area and Vicinity
merlin <i>Falco columbarius</i>	State Candidate Species	Occurs in open and wooded country, feeds primarily on small birds. Perches on rocks, posts, or on the ground, and nests in depressions on the ground or in old nests in trees near open country (Ennor 1991).	<b>Documented<sup>a</sup>.</b> Uncommon visitor to the Tri-Cities area from late September to early March. Very low numbers expected on the project site.
peregrine falcon <i>Falco peregrinus</i>	Federal Species of Concern <sup>b</sup> State Endangered Species	Feeds on birds, nests on cliff ledges and buildings (Ennor 1991).	<b>Not Documented.</b> Uncommon migrant in Tri-Cities area. Unlikely to be found on the project site, but could occur as a rare fall or winter visitor.
prairie falcon <i>Falco mexicanus</i>	Not included on any federal or state lists, but mentioned as a species of concern by the LCBAS.	Occurs in arid regions, particularly near cliffs along rivers and in mountains or foothills. Feeds on birds, rodents, large insects, lizards, or snakes. Nests on a cliff ledge or old hawk or crow nest (Ennor 1991).	<b>Documented<sup>a</sup>.</b> 15 observations (10 during in-transit surveys, five during fixed point surveys). Uncommon resident in eastern Washington, infrequent sightings in the Tri-Cities area (Ennor 1991).
sage grouse <i>Centrocercus urophasianus</i>	Federal Species of Concern <sup>b</sup> State Threatened Species	Historically, were found in the shrub-steppe and meadow steppe regions of eastern Washington, usually in areas with medium to dense sagebrush and a variety of forbs and grasses. Declined since the early 1900's due to habitat loss and degradation (WDFW 2000).	<b>Not documented.</b> May have occurred in the project area historically, but suitable habitat is very limited.
burrowing owl <i>Athene cunicularia</i>	Federal Species of Concern <sup>b</sup> State Candidate Species	Occurs in open areas, nests in burrows dug by badgers or other mammals. Feeds on insects, rodents, lizards, frogs, and small birds (Ennor 1991).	<b>Not Documented<sup>a</sup>.</b> Two historic breeding locations approximately 3 miles northeast of project area (WDFW Reports from 1990 to 1999). Not observed during 2001 owl surveys. Common in Tri-Cities area from mid-April to early September (Ennor 1991).

**Table 20 (continued).**

<b>Species/Ecosystem</b>	<b>Status</b>	<b>Habitat</b>	<b>Occurrence in Project Area and Vicinity</b>
short-eared owl <i>Asio flammeus</i>	Not included on any federal or state lists, but mentioned as a species of concern by LCBAS.	Occurs in open country, forest clearings, CRP grasslands and marshy areas. Feeds on small rodents and nests on the ground (Ennor 1991).	<b>Documented<sup>a</sup>.</b> Four observations made during in-transit surveys at Zintel Canyon; short-eared owls have been reported in the general Tri-Cities area (Ennor 1991).
snowy owl <i>Nyctea scandiaca</i>	Not included on any federal or state lists, but mentioned as a species of concern by LCBAS.	Primarily feeds on mice and lemmings; may be dependent on lemming populations. Nests in the Arctic tundra (Ennor 1991).	<b>Documented<sup>a</sup>.</b> report by landowner near Nine Canyon project. Rare winter visitor to the Tri-Cities area when Arctic lemming populations are low. May pass through the project area and could potentially forage in grasslands and stubble fields.
Vaux's swift <i>Chaetura vauxi</i>	State Candidate Species	Inhabits riparian thickets, woodlands, orchards, rocky cliffs, talus slopes, and rimrock areas (Ennor 1991).	<b>Documented<sup>a</sup>.</b> Documented during Nine Canyon surveys, but not Zintel Canyon surveys. Nesting and roosting habitat for this species does not occur in the project area. Occurs as an uncommon migrant.
Lewis' woodpecker <i>Melanerpes lewis</i>	State Candidate Species	Feeds on grasshoppers, beetles, and crickets on the ground, nests in natural cavities or drills holes in dead or decaying wood, usually large trees in open country (Ennor 1991).	<b>Not Documented.</b> Uncommon migrant in Tri-Cities area in spring and fall. Unlikely to be found on the project site, but could occur as an uncommon visitor in spring and fall.
sage sparrow <i>Amphispiza belli</i>	State Candidate Species	Restricted to sagebrush/chaparral habitat. Feeds on insects, nests on the ground or in sagebrush.	<b>Documented<sup>a</sup>.</b> several observations made along Owens Road. Occurs in the Tri-Cities area and throughout the Great Basin. Zintel Canyon is the only potential habitat near the proposed facilities.
loggerhead shrike	State Candidate Species	Typically nests in mature sagebrush habitat.	<b>Documented<sup>a</sup></b> observations along Owens Road and road to Jump Off Joe Butte.

**Table 20 (continued).**

<b>Species/Ecosystem</b>	<b>Status</b>	<b>Habitat</b>	<b>Occurrence in Project Area and Vicinity</b>
sandhill crane ( <i>Grus canadensis</i> )	State Endangered Species	Breeding in Washington only known to occur in western Yakima and Klickitat counties. Migration common throughout the Columbia Basin.	<b>Documented.</b> Unlikely breeding resident due to lack of habitat, possible migrant or transient during post breeding dispersal
<b>Habitats and Ecosystems</b>			
threetip sagebrush/Idaho fescue Shrub Herbaceous Vegetation <i>Artemisia tripartite</i> / <i>Festuca idahoensis</i>	High Quality Terrestrial Ecosystem – WNHP	Areas dominated by native threetip sagebrush and Idaho fescue with little disturbance.	This ecosystem occurs on the north slope of Jump off Joe, but will not be impacted by the project.
Wyoming big sagebrush/bluebunch wheatgrass Shrub Herbaceous Vegetation <i>Artemisia tridentata ssp. wyomingensis</i> / <i>Pseudoroegneria spicata</i>	High Quality Terrestrial Ecosystem – WNHP	Areas dominated by native Wyoming big sagebrush and bluebunch wheatgrass with little disturbance.	This ecosystem occurs within a 1-mile radius of the project within Zintel Canyon. A small portion will be temporarily impacted by the gravel quarry.
Shrub-Steppe Habitat – Four Mile and Zintel Canyons	Priority Habitat – WDFW	No description provided in PHS database, but is likely the same area as the above WNHP high quality ecosystem	A small portion will be temporarily impacted by the proposed gravel quarry. Turbine string will be adjacent to some of this shrub steppe habitat near the gravel quarry
Shrub-Steppe Habitat – Nine Canyon	Priority Habitat – WDFW	Shrub-steppe – used but intact community – upland birds, raptor feeding and nesting, nongame birds, deer.	Occurs in Nine Canyon at least 2-miles to the east of the project area.

<sup>a</sup> Documented implies species was observed during baseline surveys (Nine Canyon or Zintel Canyon) or by others (e.g. landowners) within the vicinity of the project.

<sup>b</sup> Designation provided by the WNHP. The USFWS does not typically report Species of Concern.

**Table 20 (continued).**

***Federal Status:***

**Threatened:** Any taxon that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been formally listed as such in the Federal Register under the Federal Endangered Species Act.

**Candidate:** Taxa for which current information indicates the probable appropriateness of listing as Endangered or Threatened and that has been published in the Federal Register as a candidate for listing under the Federal Endangered Species Act.

**Species of Concern:** Species whose conservation standing is of concern but for which status information is still needed. Species of concern lists are not published in the Federal Register.

***State Status:***

**Endangered:** Any taxon in danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree.

**Threatened:** Any taxon likely to become endangered in Washington within the foreseeable future if factors contributing to its population decline or habitat degradation or loss continue.

**Candidate:** Taxa under review for listing.

***Other Status:***

**High Quality Ecosystem:** Washington Natural Heritage Program designation. Determined by the characteristics of each individual ecosystem type. Ecological quality refers to both the ecological condition and the degree of viability of a particular community.

**Priority Habitat:** Washington Department of Fish and Wildlife designation. Priority habitats are those habitat types or elements with unique or significant value to a diverse assemblage of species. A priority habitat may consist of a unique vegetation type or dominant plant species, a described successional stage, or a specific structural element.

Endangered, Threatened, Special Status Species and Species of Local Concern, and High Quality/Priority Habitats Documented in the Project Vicinity

Twelve species that are either state or federal listed species or were identified as species of local concern were documented in the project area or within a 3-mile radius. These species include burrowing owl, ferruginous hawk, golden eagle, loggerhead shrike, merlin, prairie falcon, sandhill crane, short-eared owl, snowy owl, Swainson's hawk, Townsend's ground squirrel and Vaux's swift. Seven of the twelve species were observed during the 2001-2002 avian use surveys - loggerhead shrike, merlin, prairie falcon, sandhill crane, short-eared owl, Swainson's hawk, Townsend's ground squirrel. The Townsend's ground squirrel is listed only because it is a prey item for ferruginous hawks and other raptors.

*Ferruginous hawks*, a state-listed threatened species, have been observed in the project vicinity during avian use field surveys conducted in 2000 and 2001 at Nine Canyon, but not during the avian use field surveys at Zintel Canyon. The WDFW database contains four historic ferruginous hawk nest sites that were visited during the nest survey; only one of the sites was active in 2001, and is also active in 2002. Results of the field surveys indicate raptor activity (including ferruginous hawk) is low in the project area compared to five years ago when the area contained multiple active nests and territories. One active nest was documented approximately 3.5 miles southwest of the proposed project facilities.

WDFW has written a state recovery plan for the ferruginous hawk (WDFW 1996). The recovery objective for possible de-listing from State Threatened status for the state of Washington is the establishment of a population of at least 60 pairs, measured annually by the number of nests with eggs, averaged over five years. The Zintel Canyon and Nine Canyon Project sites are located within the south recovery zone, which has a recovery objective of at least 10 pairs.

The *Swainson's hawk* is not a federal or state-listed species, but was mentioned by agency biologists as a species of concern for the project. Swainson's hawks were observed occasionally in the project vicinity during in-transit surveys and fixed-point surveys. In addition, the nearest active Swainson's hawk nest was found approximately 2 miles northwest of the project area (2001), with another nest approximately 2.3 miles to the southwest of the project. Four other active Swainson's hawk nests were documented in 2001, but all are greater than 4 miles away from the proposed turbine strings.

The *golden eagle*, a State Candidate species, is uncommon in the general Tri-Cities area; and very rarely observed during mid-summer. No golden eagle observations were made during the Zintel Canyon surveys, but one unidentified eagle observation (bald or golden) was made near station E. Three golden eagle observations were made during the avian use surveys at Nine Canyon.

The *merlin*, a State Candidate species, is an uncommon winter visitor to the general Tri-Cities area. Since it forages in open country it could potentially use the project area. Two merlin observations were made, one near station F and one near station J. One merlin was observed incidentally along lower Blair Road on November 16, 2000 during the vegetation mapping field project for the Nine Canyon Project.

Like Swainson's hawk, the *prairie falcon* is not a federal or state-listed species, but was mentioned by LCBAS biologists as a species of concern for the project. No active prairie falcon nests were found during on-site nest surveys conducted in 2001 of the project area and the surrounding 5-mile (2001) radius. However, 15 observations of prairie falcons were made during in-transit and fixed point surveys at Zintel Canyon and four during surveys at Nine Canyon.

The *burrowing owl*, a State Candidate species, has been documented within a 3-mile radius of the project area. Two breeding locations, approximately 3 miles northeast of the project area, were reported by WDFW based on reports from 1990 to 2001. Ennor (1991) reports that burrowing owls are quite numerous in the Tri-Cities area from mid-April to early September in fields with cutbanks, broken culverts, or abandoned animal tunnels. Burrowing owls have not been observed near the Nine Canyon or Zintel Canyon Project sites, and habitat is limited since most of the site is under cultivation. During surveys of possible suitable habitat in 2002, no burrowing owls or indications of their presence were located.

The *snowy owl* is not a designated federal or state-listed species, but was brought up as a species of concern for the project by the LCBAS. The snowy owl is primarily an arctic species and is uncommon in Washington; it has been reported as a rare visitor to the Tri-Cities area in winter (Ennor 1991) and birders observed a total of seven individuals throughout the state of Washington during the winter of 2000-2001. It feeds primarily on lemmings and mice. When lemming populations are low in the arctic, it can be found as far south as the Tri-Cities area and could use the project area to forage for mice. Landowners in the vicinity of the project area have reported observing an occasional snowy owl in 1998 and 1999 during the winter months near the intersection of Mills Road and Nine Canyon Roads near the Nine Canyon Project.

Like the snowy owl, the *short-eared owl* is not a federal or state-listed species, however it was brought up as a species of concern for the project by the LCBAS. This species occurs in open country where it forages on small rodents. Nests are infrequently found in grassland habitat within the Columbia Basin. Since open habitat occurs in the project area, this species could be found there. Four observations were made during avian use surveys at Zintel Canyon to the north of Jump Off Joe. Two observations were made in May and June 2001 during in-transit surveys at the Nine Canyon Project site.

The *loggerhead shrike* is a State Candidate species, and has been documented in the project area. Seven observations (four in-transit and three during fixed pint surveys) were made during Zintel Canyon surveys.

*Vaux's swift* is a State Candidate species, and a rare migrant in the spring and summer to the general Tri-Cities area (Ennor 1991). It inhabits riparian thickets, woodlands, orchards, rocky cliffs, talus slopes, and rimrock areas. Since these habitats do not occur in the project area, the Vaux's swift is unlikely to be found there except during migration. A total of 15 individuals in 3 groups were observed during the fall migration period while conducting fixed-point surveys at Nine Canyon, but no observations were made during Zintel Canyon surveys.

*Sandhill cranes*, a State Endangered species, have been documented in the project area. In Washington, they breed only in western Yakima and Klickitat counties (Smith *et al.* 1997). This species was observed during avian surveys on the site during the spring migration (four flocks) and fall migration seasons (one flock). Sandhill cranes are known to forage in grain fields. During migration, sandhill cranes will move in large flocks and will soar at high altitudes riding thermals very high to allow long distance movements.

The *sage thrasher*, a State Candidate species, is primarily an eastern Washington species and is fairly common in appropriate habitats in the Tri-Cities area. It is found almost exclusively with big sagebrush (*Artemisia tridentata*) This species was documented during the breeding season surveys along Owens road in shrub-steppe habitat.

The *sage sparrow*, a State Candidate species, is restricted to sagebrush/chaparral habitat. This species was documented during the breeding season surveys along Owens road in shrub-steppe habitat.

Three high quality/priority habitats are documented within the project vicinity. Both the threetip sagebrush/Idaho fescue and Wyoming big sagebrush/bluebunch wheatgrass terrestrial ecosystems occur within a 3-mile radius of the project area. The Wyoming big sagebrush/bluebunch wheatgrass is found in Zintel Canyon, with a small portion temporarily impacted by the quarry site. The other high quality habitats will not be impacted.

## Endangered, Threatened, and Special Status Species Potentially Occurring in the Project Vicinity

Many of the state-listed species have not been documented on the project site or within a 3-mile radius; however, they may potentially occur there occasionally or rarely as a migrant or visitor. All of the bird species, as well as the Yuma myotis and the Townsend's big-eared bat, are included in this category (except sage grouse, which have been extirpated) since there is the potential for them to migrate through the project area. Jackrabbits are also included based on suitable habitat.

The *Yuma myotis* is a federal species of concern. The project area contains very little to no roosting or foraging habitat for the Yuma myotis, which is typically associated with water. Very little is known about this species in the Columbia Basin, however it is possible that a short-distance migrant could pass through the project area during migration (Hayes and Waldien 2000).

The project area has limited roosting habitat for *Townsend's big-eared bat*, a State Candidate species. This species typically roosts and hibernates in caves, abandoned mines, and buildings. Nursery colonies are usually found in caves and sometimes in old buildings. One breeding/wintering site was found approximately 50 miles southeast of the project area in forested habitat (Kronner, field notes 1998-2001). They are unlikely to occur in the project area.

Both the *black-tailed and white-tailed jackrabbit* are State Candidate species, and occur in open habitat such as grassland or sagebrush-steppe. Since this habitat is found within and near the project area, these species could be found there; however, there have been no documented sightings during the Zintel Canyon surveys.

The *American white pelican*, a State Endangered species, inhabits lakes or rivers where it feeds and nests. Since the project area has no water sources, it is not likely to be found there. However, the American white pelican is a migrant, and therefore could potentially migrate through the project area seasonally. This species nests on dredge spoil islands on the Columbia River near the Tri-Cities (Denny 2000, Fitzner 2000) and soars between foraging sites along the Columbia River. The project area is not expected to be within a flight path.

The *bald eagle* is a Federal and State Threatened species which can be found in the wintering and migrating through the general Tri-Cities area from November through March (Ennor 1991). It is most likely to be found along the Columbia River where it feeds on fish; however, bald eagles also feed on carrion and small mammals in upland areas and thus could use the project area if carrion (dead cattle or game, road-killed animals) or small mammals are available.

The *peregrine falcon* is a State Endangered species. It is an uncommon winter migrant in the general Tri-Cities area, and feeds primarily on birds (Ennor 1991) close to bodies of water. Peregrine falcons are considered rare in upland areas. There is a low potential for the peregrine falcon to forage in the project area during the winter, or to pass through the area during migration.

*Lewis' woodpecker*, a State Candidate species, is an uncommon migrant in the Tri-Cities area in spring and fall (Ennor 1991). It feeds on grasshoppers, beetles, and crickets on the ground, and it nests in natural cavities or drills holes in dead or decaying wood, usually large trees in open country (Ennor 1991). Since the project area contains potential feeding habitat, this species could occur during migration but it has not been documented. One Lewis's woodpecker fatality was observed at the nearby Vansycle Wind Plant in Oregon (Erickson *et al.* 2000), most likely migrating through the project area. Riparian habitat with scattered large willows and cottonwood trees are located within 0.25 mile of the turbines at the Vansycle Wind Plant.

#### Endangered, Threatened, and Special Status Species Unlikely to Occur in the Project Vicinity

Habitat for both of the federally-listed species, the *Ute's ladies'-tresses* and the *Untanum desert buckwheat*, does not occur in the project or surrounding area, therefore, neither of these plant species would be found there.

The WDFW reports that the *sage grouse* is believed to have been extirpated from Benton County since the 1980's, with the exception of isolated sightings during the winter of 1999-2000 in large blocks of suitable habitat several miles northwest of the project area. It is highly unlikely this species would occur in the project or surrounding area. In addition, habitat for this species is limited since most of the site is under cultivation and the native shrub-steppe habitat is patchy and fragmented.

## IMPACTS TO SPECIES/GROUPS OF CONCERN

In general, project impacts to vegetation include trampling, uprooting, or collecting, as well as loss of habitat or changes in hydrology. Potential impacts to mammals and birds include injury or mortality, loss or destruction of habitat, or avoidance of an area. Impacts may occur during project construction and/or operation.

This section describes potential impacts from the wind development project to listed endangered, threatened, and special status species, and high quality/priority habitats that are known to occur, or potentially occur, in the project area. Three species, Ute's ladies'-tresses, Untanum desert buckwheat, and sage grouse, do not occur in the project area and therefore would not be impacted. In addition, project facilities other than a portion of the gravel quarry will not be located within high quality/priority habitats that occur within a 3-mile radius of the project. This section also discusses impacts to bird groups (e.g., raptors, passerines, waterfowl) and to all birds using mortality estimates from other studies.

### Mammals

Four special status mammal species potentially occur in the project area, and therefore could be impacted by the project. These species include the Yuma myotis, Townsend's big-eared bat, black-tailed jackrabbit, and white-tailed jackrabbit.

Impacts to the Yuma myotis and Townsend's big-eared bat during construction are unlikely to occur because the project area probably does not contain roosting or hibernating sites due to lack of habitat. Impacts are possible during operation if these species are foraging or migrating through the area and strike a turbine. Bat mortality has been reported from other wind development sites, primarily during migration season; however, bat mortality at the Vansycle and Stateline Wind Projects did not include any listed species (Erickson *et al.* 2000, Erickson *et al.* 2002). Our best estimate for bat mortality would be 0.74 bats/turbine per year based on the Vansycle estimate. The actual bat mortality could vary significantly from this number, depending on the bat use of the area and the size of the project.

Any bat mortality at the project site is likely to involve non-listed species, particularly since the Yuma myotis and Townsend's big-eared bat are not known to occur in the area. However, depending on actual use of the area and migratory patterns, any impacts would probably be very infrequent and are not likely to affect populations.

Neither the black-tailed or white-tailed jackrabbit has been documented in the project area, although suitable habitat exists for these species in areas near proposed project facilities. Assuming individuals of these species occur in the project area, potential construction-related impacts include being struck by vehicles and/or holes/burrows being crushed. Probability of these impacts is low, due to low probability of occurrence. Permanent changes

to habitat as a result of operation of the project are not expected to impact these species since the amount of habitat lost to project facilities is minimal compared to the amount of suitable habitat in the general area.

## **Birds**

The most probable impact to birds resulting from the project is direct mortality or injury due to collisions with the turbines or guy wires of temporary or permanent meteorological towers. Collisions may occur with resident birds foraging and flying within the project area, or with birds migrating through the project area. Other impacts could include abandonment of the area due to disturbance caused by project construction or operation, and mortality or injury due to collisions with construction vehicles or other equipment. The potential for impacts to bird species that occur or potentially occur in the project area are summarized in Table 21.

Fatality projections are based on the results of studies conducted at the modern 38-turbine Vansycle Wind Plant in Umatilla County, Oregon (Erickson *et al.* 2000), and the modern over 400-turbine Buffalo Ridge Wind Plant in southwestern Minnesota (Johnson *et al.* 2000a). Both of these wind plants are located primarily in agricultural lands, and appear to be most similar to the project area in bird abundance and composition.

A collision fatality estimate of 0.63 birds/turbine/year was made for the Vansycle Wind Plant, based on a single year of carcass searches, and scavenging and searcher efficiency bias trials. At Buffalo Ridge, an annual fatality rate estimate of 2.8 birds/turbine/year was made based on four years of similar monitoring. Therefore, our expected range for the Zintel Canyon Project site is 0.63-2.8 bird fatalities/turbine/year. For a 37-turbine wind plant, this equates to an estimate of 24 to 104 total avian fatalities per year. Preliminary operational monitoring data collected at the Stateline Wind Plant between July 2001 and May 31, 2002 suggest an all bird mortality estimate in this range. The actual mortality could vary significantly from these projections and would depend on many factors including the actual number of turbines developed, and other unmeasured factors.

**Table 21. Collision risk for Federal and State Endangered, Threatened, and Special Status bird species occurring or potentially occurring in the Project Area.**

Species	Risk Factors		General Level of Risk of Collision (annual)
	Behavior Factors	Occurrence in Project Area	
American white pelican <i>Pelecanus erythrorhynchos</i>	Flight heights could include rotor area; typically flies during the day and is assumed to see the turbines.	Low occurrence in the project area; most likely to be found along the Columbia River several miles north of the project area. Could occur during migration. May soar over occasionally.	Very Low
bald eagle <i>Haliaeetus leucocephalus</i>	Feeds on carrion in the winter. Flight heights could include rotor area.	Low occurrence in the project area, more likely to be found along the Columbia River several miles north and east of the project area. Could occasionally forage in project area.	Very Low
ferruginous hawk <i>Buteo regalis</i>	Hunts small/medium mammals, birds, and reptiles in open country. Commonly observed, but no fatalities recorded at wind plant site in Wyoming – (Johnson <i>et al.</i> 2000b).	Observed in project vicinity. Historic nests within 2-mile radius of project area, and one active nest documented 4 miles to southwest. May forage in CRP grasslands, shrub-steppe and stubble fields.	Low
Swainson’s hawk <i>Buteo swainsoni</i>	Hunts insects, small mammals, reptiles, amphibians, and birds in open country.	Observed in project vicinity. Nearest active nests documented 2 miles and 2.3 miles from turbine strings. Other active nests greater than 4 miles away. May forage in CRP grasslands, shrub-steppe and stubble fields.	Low-Moderate
golden eagle <i>Aquila chrysaetos</i>	Hunts small/medium mammals, birds, and reptiles in open country. Reports of fatalities from other wind plant sites.	Observed in project area (Nine Canyon). Could occur as an occasional visitor in the winter months to forage.	Low

**Table 21 (continued)**

Species	Risk Factors		General Level of Risk of Collision (annual)
	Behavior Factors	Occurrence in Project Area	
merlin <i>Falco columbarius</i>	Uses a variety of open and wooded habitats. Flight height could include rotor area.	Could occur as a uncommon visitor in the winter months or during migration.	Very Low
peregrine falcon <i>Falco peregrinus</i>	Uses open habitats, hunts primarily small birds. Flight height could include rotor area.	Reported as rare in Tri-Cities area, could occur as occasional winter visitor and during migration.	Very Low
prairie falcon <i>Falco mexicanus</i>	Hunts small mammals, birds, and reptiles in open country. Flight height could include rotor area.	Observed within project area.	Low
burrowing owl <i>Athene cunicularia</i>	Nests in mammal burrows and forages primarily on insects. Migrates at heights that could include rotor area. Reports of fatalities from other wind plant sites.	Documented nesting sites approximately 3 miles from the project area. Not observed in project area, habitat may be limited.	Low
short-eared owl <i>Asio flammeus</i>	Hunts small mammals in open country with criss-crossing flights close to the ground.	Documented in the project area; reported from the general Tri-Cities area.	Low
snowy owl <i>Nyctea scandiaca</i>	Primarily hunts lemmings and mice.	Arctic species that could occur in the general area rarely when prey abundance is low in the arctic. Could occur in project area during migration/foraging.	Very Low
Vaux's swift <i>Chaetura vauxi</i>	Inhabits riparian thickets, woodlands, orchards, rocky cliffs, talus slopes, and rimrock.	Nesting and roosting habitat for this species does not occur in the project area. Very unlikely to be found except during migration.	Low
Lewis' woodpecker <i>Melanerpes lewis</i>	Feeds on grasshoppers, beetles, and crickets on the ground, nests in natural cavities or drills holes in dead or decaying wood, usually large trees in open country.	Unlikely to be found on the project site, but could occur as an uncommon visitor in spring and fall.	Low

**Table 21 (continued)**

<b>Species</b>	<b>Risk Factors</b>		<b>General Level of Risk of Collision (annual)</b>
	<b>Behavior Factors</b>	<b>Occurrence in Project Area</b>	
sage thrasher <i>Oreoscoptes montanus</i>	Occurs almost exclusively with <i>Artemisia tridentata</i> .	Species documented in Zintel Canyon in native habitat.	Low
loggerhead shrike <i>Lanius ludovicianus</i>	Occurs in open country where it feeds on mice, insects, lemmings, and small birds, nests in bushes or trees.	Observed during fixed point surveys and in Zintel Canyon during breeding season.	Low
sandhill crane <i>(Grus canadensis)</i>	Breeding in Washington only known to occur in western Yakima and Klickitat counties. May forage in grain fields.	Observed during migration. Unlikely breeding resident due to lack of habitat, possible migrant or transient during post breeding dispersal	Low
sage sparrow <i>Amphispiza belli</i>	Restricted to sagebrush/chaparral habitat. Feeds on insects, nests on the ground or just above ground in sagebrush. Forages on the ground or in low shrubs.	Species documented in Zintel Canyon in native habitat.	Low

## Raptors

Overall raptor mortality for this project is expected to be very low, considering the relatively low raptor use and nesting density raptors in the project area, the expected small size of the project, the type and configuration of turbines and the very low raptor mortality observed at other new wind plants (Erickson *et al.* 2001, Erickson *et al.* 2002). We would expect low raptor mortality, with no raptor mortality in most years of operation, and a potential for an occasional raptor fatality over the life of the project. The raptors expected to be at most risk of collision are the species most abundant in the study area. Red-tailed hawks, northern harriers, Swainson's hawks, rough legged hawks and American kestrels are expected to be most at risk, with a much lesser risk to ferruginous hawks, golden eagles, prairie falcons, merlins and other species that may occasional pass through the project area. Raptor nesting density is low in the project vicinity and no raptor nests will be disturbed by construction and operation of the wind plant. Fledglings from nests in the area may be more susceptible to collision. One active ferruginous hawk nest was located approximate 3.5 miles to the southwest of the project site during nest surveys in 2001. The nearest active Swainson's hawk nests were found approximately 2 miles northwest and 2.3 miles south of the proposed project facilities. Three other active Swainson's hawk nests were located in 2001, but all were greater than 4 miles away from the project site. We do not expect any disturbance impacts to burrowing owl nests; the known historic burrowing owl nest sites are approximately 3 miles from the project area. Burrowing owls, short-eared owls and great horned owls may collide with the turbines, but given the turbines are all proposed to be located in wheat fields, this risk is expected to be very low.

## Passerines

Passerines (primarily perching birds) have been the most abundant avian fatality at wind plants outside California (Erickson *et al.* 2001b, Erickson *et al.* 2002), often comprising more than 80% of the avian fatalities. Both migrant and resident passerine fatalities have been observed. Given that passerines make up a large proportion of the observations, we would expect passerines to make up the largest proportion of fatalities. Common resident species such as horned larks and western meadowlarks would be most at risk. Nocturnal migrating species may also be affected, but would not be expected to be found in large numbers based on data collected at other wind plants (no large mortality events documented, Erickson *et al.* 2001b, Erickson *et al.* 2002).

## Waterfowl

The only species of waterfowl observed in the project area was Canada goose. Although some waterfowl mortality has been documented at other wind plants (e.g., Johnson *et al.* 2000a) studies of wind plants situated in similar agricultural areas used by Canada geese (e.g, Buffalo Ridge [MN], Klondike [OR], Stateline [OR\WA], Vansycle [OR],) have documented only one goose mortality. Some waterfowl collisions with turbines at the Zintel Canyon Project site are possible, as waterfowl can be expected to fly over the project area en-route to the Columbia and Yakima Rivers and adjacent uplands. Since the project area experiences dense fog during the winter months, waterfowl flying at lower altitudes may collide with the

turbines. However, based on results of other studies in similar habitats, we expect mortality to be insignificant.

#### Other Groups/Species

Other avian groups occur in relatively low numbers within the project area and mortality would be expected to be low. Other species of concern such as loggerhead shrikes, sage thrashers and sage sparrows may be at some risk of collision with turbines, but this risk would be expected to be low, since turbines will be located in wheat fields. Other species only observed during migration may be at risk, however mortality is expected to be relatively low, given the size of the project.

### **OPERATIONAL MONITORING PLAN**

A detailed protocol for monitoring the impacts of the Nine Canyon wind plant has been developed and will be implemented when all turbines are operational (Energy Northwest *et al.* 2002). The Monitoring Plan for the Nine Canyon Project consists of the following components: 1) fatality monitoring involving standardized carcass searches, 2) a Wildlife Response and Handling System (WRHS) for reporting of incidental fatalities by maintenance personnel and others and for handling injured birds, 3) scavenging trials, 4) searcher efficiency trials and 5) a Technical Advisory Committee (TAC) to evaluate the monitoring program and determine the need for further studies. The Nine Canyon TAC is composed of representatives from Energy Northwest, the Lower Columbia Basin Audubon Society, Washington Department of Fish and Wildlife, U. S. Fish and Wildlife Service, Benton County representatives, the landowners, and consultants conducting the monitoring studies. The TAC will evaluate the operational monitoring data collected for the adjacent Nine Canyon Project to determine the monitoring requirements for the Zintel Canyon Project. At a minimum, the Wildlife Response and Handling System for reporting of fatalities and handling and reporting injured birds by maintenance personnel will be in place for the life of the Zintel Canyon Wind Project.

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**Figure 1. Location of the Nine Canyon wind turbines and the approximate location of the Zintel Canyon turbine strings.**

**Figure 2. Location of the Zintel Canyon (E-J) and Nine Canyon (A-D) avian observation stations.**

**Figure 3. Approximate location of the Zintel Canyon breeding bird survey stations along Owens Road.**

**Figure 4. 2001 raptor/raven nest survey area and approximate active raptor and common raven nest locations.**

**Figure 5. Vegetation map for the Zintel Canyon Wind Project site.**

**Figure 6. Mean use estimates for all birds, passerines and raptors and the number of species/survey estimates by season and location. 95% confidence intervals are also presented.**

**Figure 7. Approximate flight paths for red-tailed hawks, rough-legged hawks, Swainson's hawks and unidentified buteos based on fixed-point and in-transit observations at the Zintel Canyon Wind Project site.**

**Figure 8. Approximate flight paths for northern harriers based on fixed-point and in-transit observations at the Zintel Canyon Wind Project Site.**

**Figure 9. Approximate flight paths for American kestrels, merlins and prairie falcons based on fixed-point and in-transit observations at the Zintel Canyon Wind Project site.**

**Figure 10. Approximate flight paths for Canada geese, great blue herons, great horned owls, loggerhead shrikes, northern shrikes, sandhill cranes, short-eared owls, sharp-shinned hawks, unidentified eagles, and unidentified shrikes based on fixed-point and in-transit observations at the Zintel Canyon Wind Project site**